

PROJECT MANUAL

For:

SOUTH COAST SPEEDWASH AT THE AUTOBAHN

2400-2410 Bristol St.

2400 Bldg. 1 – Carwash Bldg.

2400 Bldg. 2 – Vacuum Bldg.

2400 Bldg. 3 – Operations Admin. Bldg.

2410 Suites A-G – Retail Bldg.

Santa Ana, California

Project No. 2015270

A Project for

BRISTOL SPEEDWASH, INC.

10801 National Blvd., Suite 510

Los Angeles, California 90064

MAY, 2017

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SECTION 01010 - SUMMARY OF WORK**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 CONSTRUCTION MANAGEMENT.

- A. The Project Manager for the project is:

Mr. David Cacon
DC DESIGN + BUILD
CONSULTANTS
6285 E. Spring Street, 502
Long Beach, CA 90808

Telephone: (562) 912-4884
Fax: (562) 349-0235

1.2 WORK COVERED BY CONTRACT DOCUMENTS.

- A. The Project consists of the general construction of a site for a car wash facility, office and retail buildings in Santa Ana, California

1. Project Location: 2400 Bristol St., Santa Ana, California 92704
2. Owner: Bristol Speedwash, Inc. 10801 National Blvd., Suite 510, Los Angeles, California 90064

- B. Contract Documents which consist of:

1. Drawings
2. Reports
3. Calculations

Dated May 2017 were prepared for the Project by William Hezmalhalch Architects, Inc. 2850 Redhill Ave. Suite 200, Santa Ana, California 92705.

- C. The Work will be constructed under a single prime contract.

1.3 CONTRACTOR USE OF PREMISES.

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

1.4 SCOPE OF WORK SUMMARY.

A. This project consists of the following components:

1. Demolition of an existing carwash building and associated site improvements. Some underground demolition and removal of existing tanks, lines and utility services to be performed. Demolition of existing street improvements and utilities to prepare for new improvements.

Refer to drawings, specification and reports for a complete scope of work.

2. On Site improvements to include but not limited to grading, underground trenching of conduit and system lines, placement of underground tanks, backflow preventers, fire line connections / valves, placement of transformers, utility connection(s), storm drain system, sewer system with integral sand oil interceptors, construction of new sound wall at property line, repair and or extend existing CMU walls at property lines, landscape CMU walls, removal of existing power poles and undergrounding of utilities located on said poles, conduit for pay station and vacuum systems, concrete paving throughout site, parking lot striping, water features, site lighting, security camera system, and landscape improvements.

Refer to drawings, specification and reports for a complete scope of work.

3. Off Site improvements include new curb, gutter and sidewalk in street right of way along Bristol. Utility connections and meters per plan and City standards. Traffic striping and signage per plans. Contractor to provide necessary traffic control and coordination with City Public Works department.

Refer to drawings, specification and reports for a complete scope of work.

4. Construction of the following buildings with complete building systems (Architectural, Fire prevention, Structural, Mechanical, Electrical and Plumbing):

- a. Carwash Building-2-story with integral pit slab for carwash belt system and attached canopy
- b. Operations Administration Building- 2 story office building with pay station canopy and entrance limit arch.
- c. Retail Building-1 story building
- d. Vacuum Building with connected canopy with mounted solar panel system
- e. Trash Enclosure

Refer to drawings, specification and reports for a complete scope of work.

5. Car Wash Equipment, Low Voltage, Security and associated systems:

- a. The contractor shall be responsible for the coordination of all systems pertaining to the security, data, vacuum system, car wash equipment MCC panel(s), and tunnel belt system MMC Panel(s). This includes the conduit, system lines and low voltage associated with said systems to have a coordinated and complete system.
- b. The Car Wash Equipment, belt system(s), vacuum system, reclaim water system will be installed by owner's vendors. However, points of connection to be provided by contractor per plans and coordinated with the latest approved shop drawings for each system.
- c. The data, security (including cameras) and low voltage systems will be installed by owner's vendor.
- d. Contractor and sub-contractors will be required to attend coordination meetings with each vendor of said systems.

Refer to drawings, specification and reports for a complete scope of work.

6. Furniture, Fixtures and Equipment not mentioned in item 4 above shall be purchased by owner, protected and stored on site by contractor at an agreed time and place during the construction process. The owner shall provide a listing of the items and their specification for coordination within 21-days of commencement of project.
Refer to drawings, specification and reports for a complete scope of work.

7. Building, Site and wayfinding Signage shall be paid for by owner and installed by owner's vendor. Contractor shall coordinate mounting, power and architectural finish detailing with Sign Contractor. Contractor shall be responsible for all signs required for certificate of occupancy to include but limited to exit, room, equipment labels, panel labels, fire and ADA signage.
Refer to drawings, specification and reports for a complete scope of work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01010

SECTION 01027 - APPLICATIONS FOR PAYMENT**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 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
 - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
- C. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section "Submittals."

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
- B. Coordination: Each prime Contractor shall coordinate preparation of its Schedule of Values for its part of the Work with preparation of the Contractors' Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule.
 - b. Application for Payment forms, including Continuation Sheets.
 - c. List of subcontractors.
 - d. Schedule of allowances.
 - e. Schedule of alternates.
 - f. List of products.
 - g. List of principal suppliers and fabricators.
 - h. Schedule of submittals.
 - 2. Submit the Schedule of Values to the Architect and Construction Manager at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.
- C. Format and Content: Use the Project Manual table of contents as a guide to establish the format 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 the Architect and Construction Manager.
 - c. 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 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.
- 1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.
4. Round amounts to nearest whole dollar; the 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. Include requirements for insurance and bonded warehousing, if required.
6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and Construction Manager and paid for by the Owner.
 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- D. Payment-Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.

- E. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect and Construction Manager will return incomplete applications without action.
1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- G. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to the Architect and Construction Manager by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.
- H. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien from every entity who is lawfully entitled to file a mechanics lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
- J. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
1. List of subcontractors.
 2. List of principal suppliers and fabricators.
 3. Schedule of Values.
 4. Contractor's Construction Schedule (preliminary if not final).
 5. Schedule of principal products.
 6. Schedule of unit prices.
 7. Submittal Schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from governing authorities for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction meeting.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire the Owner's insurance.
 17. Initial settlement survey and damage report, if required.
- K. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

2. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Meter readings.
 - f. Startup performance reports.
 - g. Changeover information related to Owner's occupancy, use, operation, and maintenance.
 - h. Final cleaning.
 - i. Application for reduction of retainage and consent of surety.
 - j. Advice on shifting insurance coverages.
 - k. Final progress photographs.
 - l. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

- L. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
 1. Completion of Project closeout requirements.
 2. Completion of items specified for completion after Substantial Completion.
 3. Ensure that unsettled claims will be settled.
 4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
 5. Transmittal of required Project construction records to the Owner.
 6. Certified property survey.
 7. Proof that taxes, fees, and similar obligations were paid.
 8. Removal of temporary facilities and services.
 9. Removal of surplus materials, rubbish, and similar elements.
 10. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01035 - MODIFICATION PROCEDURES**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 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
 - 3. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
 - 4. Division 1 Section "Applications for Payment" for administrative procedures governing Applications for Payment.
 - 5. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 MINOR CHANGES IN THE WORK

- A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions.

1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
 - 2. Within 20 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
 - a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

- c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect and Construction Manager.
1. Include a statement outlining the 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 Contract Time.
 2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Comply with requirements in Section "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701.

1.7 REQUEST FOR INFORMATION (RFI)

- A. The RFI shall include the following during Bidding Phase:
1. Reference to Specification and paragraph numbers.
 2. Identification of the clarification needed.
 3. Impact this clarification will have on schedule (number of days).
- B. The RFI shall include the following during the Construction Phase:
1. Identification of the construction deficiency or Contract document clarification.

2. Reference to Specification and paragraph numbers, drawing numbers and drawing reference.
 3. Impact this clarification will have on schedule (number of days) and project costs (if any).
- C. Categorize each RFI as follows:
1. Substitution/Construction Modification
 2. Clarification or Additional Information
 3. Construction Deficiency (During Construction Phase).
 4. Construction Document Deficiency
- D. Substitution/Construction Modification
1. During the Bidding Phase, a RFI for an equipment substitution or a Construction Modification should be sent to the Architect in writing at least 10 days prior to bid opening. (This request will only be answered if request is from a General Contractor who is a plan holder.)

During the Construction Phase, an RFI for an equipment substitution or a Construction Modification should be submitted immediately attaching an appropriate form, if it is not, the Engineer should return to the Contractor.
 2. Architect should take no action until the substitution request is received.
 3. Contractor shall identify the equipment substitution noting the specification or plan sheet involved and the reason for the substitution. This would include schedule impacts and costs.
 4. Contractor shall identify the construction modification by detail and plan sheet location they are considering. The construction modification request shall outline the change requested in enough detail for the Architect to review and the reasons for the change. Also included would be schedule impacts and costs.
- E. Clarification or Additional Information
1. Review the RFI request for completeness and return immediately if not complete.
 2. Review the RFI request and respond with the appropriate clarification or additional information.
 3. During the Construction phase, should the clarification or additions result in an impact on schedule and project costs the Contractor will respond within 2 working days.
 4. No work is authorized until both schedule and project costs are agreed to.
- F. Construction Deficiency (During Construction Phase Only)
1. If the RFI is about a construction deficiency, then the Architect should complete a deficiency form and submit to the Contractor.
 2. This effort should be completed as soon as discovered or as determined from the RFI.
 3. The deficiency form should request a proposal from Contractor on how to correct the problem.
- G. Construction Document Deficiency

1. Review RFI for verification of deficiency.
2. Review RFI and respond with the proposed corrections to construction documents.
3. Contractor shall review schedule and cost impact within 2 working days. No work is authorized until both schedule impact and project costs are agreed to.

H. Form to be used for RFI's:

1. AIA G716-2004 form, or a custom form mutually agreed by Architect and Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01035

SECTION 01040 - COORDINATION**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 SUMMARY

- A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Cleaning and protection.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Field Engineering" specifies procedures for field engineering services, including establishment of benchmarks and control points.
2. Division 1 Section "Project Meetings" for progress meetings, coordination meetings, and preinstallation conferences.
3. Division 1 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.
4. Division 1 Section "Materials and Equipment" for coordinating general installation.
5. Division 1 Section "Contract Closeout" for coordinating contract closeout.

1.3 COORDINATION

- A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.

- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of schedules.
 2. Installation and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project closeout activities.
- D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
1. Show the relationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.
 3. Comply with requirements contained in Section "Submittals."
- B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.
- B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 - 1. Excessive static or dynamic loading.
 - 2. Excessive internal or external pressures.
 - 3. Excessively high or low temperatures.
 - 4. Thermal shock.
 - 5. Excessively high or low humidity.
 - 6. Air contamination or pollution.
 - 7. Water or ice.
 - 8. Solvents.
 - 9. Chemicals.
 - 10. Light.
 - 11. Radiation.
 - 12. Puncture.
 - 13. Abrasion.
 - 14. Heavy traffic.
 - 15. Soiling, staining, and corrosion.
 - 16. Bacteria.
 - 17. Rodent and insect infestation.
 - 18. Combustion.
 - 19. Electrical current.
 - 20. High-speed operation.
 - 21. Improper lubrication.
 - 22. Unusual wear or other misuse.
 - 23. Contact between incompatible materials.
 - 24. Destructive testing.
 - 25. Misalignment.
 - 26. Excessive weathering.
 - 27. Unprotected storage.
 - 28. Improper shipping or handling.
 - 29. Theft.
 - 30. Vandalism.

END OF SECTION 01040

SECTION 01045 - CUTTING AND PATCHING**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 SUMMARY

- A. This Section includes administrative and procedural requirements for cutting and patching.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Coordination" for procedures for coordinating cutting and patching with other construction activities.
 - 2. Division 2 Section "Selective Demolition" for demolition of selected portions of the building for alterations.
 - 3. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - a. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - a. Foundation construction.
 - b. Bearing and retaining walls.
 - c. Structural concrete.
 - d. Structural steel.
 - e. Lintels.
 - f. Timber and primary wood framing.
 - g. Structural decking.
 - h. Stair systems.
 - i. Miscellaneous structural metals.
 - j. Exterior curtain-wall construction.
 - k. Equipment supports.
 - l. Piping, ductwork, vessels, and equipment.
 - m. Structural systems of special construction in Division 13 Sections.
- B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and

patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

- a. Primary operational systems and equipment.
- b. Air or smoke barriers.
- c. Water, moisture, or vapor barriers.
- d. Membranes and flashings.
- e. Fire protection systems.
- f. Noise and vibration control elements and systems.
- g. Control systems.
- h. Communication systems.
- i. Conveying systems.
- j. Electrical wiring systems.
- k. Operating systems of special construction in Division 13 Sections.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1. If possible retain the original Installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original Installer or fabricator, engage another recognized experienced and specialized firm.

- a. Processed concrete finishes.
- b. Stonework and stone masonry.
- c. Ornamental metal.
- d. Matched-veneer woodwork.
- e. Preformed metal panels.
- f. Firestopping.
- g. Window wall system.
- h. Stucco and ornamental plaster.
- i. Acoustical ceilings.
- j. Terrazzo.
- k. Finished wood flooring.
- l. Fluid-applied flooring.
- m. Carpeting.
- n. Aggregate wall coating.
- o. Wall covering.
- p. Swimming pool finishes.
- q. HVAC enclosures, cabinets, or covers.

1.4 WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.
 - 1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
 - 4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.

5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.
4. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.4 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

SECTION 01200 - PROJECT MEETINGS**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 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
 - 1. Preconstruction conferences.
 - 2. Preinstallation conferences.
 - 3. Progress meetings.
 - 4. Coordination meetings.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Coordination" for procedures for coordinating project meetings with other construction activities.
 - 2. Division 1 Section "Submittals" for submitting the Contractor's Construction Schedule.

1.3 PRECONSTRUCTION CONFERENCE

- A. Schedule a preconstruction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 15 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress, including the following:
 - 1. Tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.
 - 6. Distribution of Contract Documents.
 - 7. Submittal of Shop Drawings, Product Data, and Samples.
 - 8. Preparation of record documents.
 - 9. Use of the premises.
 - 10. Parking availability.
 - 11. Office, work, and storage areas.
 - 12. Equipment deliveries and priorities.

13. Safety procedures.
14. First aid.
15. Security.
16. Housekeeping.
17. Working hours.

1.4 PREINSTALLATION CONFERENCES

- A. Conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.
- B. Attendees: The 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 the Architect of scheduled meeting dates.
 1. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related Change Orders.
 - d. Purchases.
 - e. Deliveries.
 - f. Shop Drawings, Product Data, and quality-control samples.
 - g. Review of mockups.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's recommendations.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities.
 - q. Space and access limitations.
 - r. Governing regulations.
 - s. Safety.
 - t. Inspecting and testing requirements.
 - u. Required performance results.
 - v. Recording requirements.
 - w. Protection.
 2. Record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.
 3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project Site at regular intervals. Notify the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner and the Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.
 - 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
 - 2. Review the present and future needs of each entity present, including the following:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences.
 - d. Status of submittals.
 - e. Deliveries.
 - f. Off-site fabrication problems.
 - g. Access.
 - h. Site utilization.
 - i. Temporary facilities and services.
 - j. Hours of work.
 - k. Hazards and risks.
 - l. Housekeeping.
 - m. Quality and work standards.
 - n. Change Orders.
 - o. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - 1. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.6 COORDINATION MEETINGS

- A. Conduct project coordination meetings at regular intervals convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special preinstallation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

- C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01200

SECTION 01300 - SUBMITTALS**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 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Daily construction reports.
4. Shop Drawings.
5. Product Data.
6. Samples.
7. Quality assurance submittals.

- B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of subcontractors.

- C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Applications for Payment" specifies requirements for submittal of the Schedule of Values.
2. Division 1 Section "Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
3. Division 1 Section "Quality Control" specifies requirements for submittal of inspection and test reports.
4. Division 1 Section "Contract Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.3 DEFINITIONS

- A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

1. Preparation of Coordination Drawings is specified in Division 1 Section "Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
- B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
 3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
 - a. Allow 2 weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow 2 weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of the Architect.
 - d. Name and address of the Contractor.
 - e. Name and address of the subcontractor.
 - f. Name and address of the supplier.
 - g. Name of the manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Approximate lead time.

- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor.
1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
 2. Transmittal Form: Use AIA Document G810.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 30 days after the date established for "Commencement of the Work."
1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner affect the sequence of Work.
- C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparation of payment requests.
1. Refer to Division 1 Section "Applications for Payment" for cost reporting and payment procedures.

- F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Construction Manager, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
 - 1. When revisions are made, distribute 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 construction activities.
- G. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.
 - 1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
 - 2. Prepare the schedule in chronological order. Provide the following information:
 - a. Scheduled date for the first submittal.
 - b. Related Section number.
 - c. Submittal category (Shop Drawings, Product Data, or Samples).
 - d. Name of the subcontractor.
 - e. Description of the part of the Work covered.
 - f. Scheduled date for resubmittal.
 - g. Scheduled date for the Architect's final release or approval.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Construction Manager, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
 - 1. When revisions are made, distribute 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 construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Architect at weekly intervals:
 - 1. List of subcontractors at the site.
 - 2. Approximate count of personnel at the site.
 - 3. High and low temperatures, general weather conditions.
 - 4. Accidents and unusual events.
 - 5. Meetings and significant decisions.
 - 6. Stoppages, delays, shortages, and losses.
 - 7. Meter readings and similar recordings.

8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

1.8 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
 1. Dimensions.
 2. Identification of products and materials included by sheet and detail number.
 3. Compliance with specified standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm).
 7. Initial Submittal: Submit 2 blue- or black-line prints for the Architect's review. The Architect will return one print.
 8. Final Submittal: Submit 3 blue- or black-line prints and 2 additional prints where required for maintenance manuals, plus the number of prints needed by the Architect for distribution. The Architect will retain 2 prints and return the remainder.
 - a. One of the prints returned shall be marked up and maintained as a "Record Document."
 9. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.9 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
4. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Architect will retain one and will return the other marked with action taken and corrections or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:
 - a. Specification Section number and reference.
 - b. Generic description of the Sample.
 - c. Sample source.
 - d. Product name or name of the manufacturer.
 - e. Compliance with recognized standards.
 - f. Availability and delivery time.
 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

- d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.
 - a. The Architect will review and return preliminary submittals with the Architect's notation, indicating selection and other action.
4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Architect will return one set marked with the action taken.
5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
 1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 ARCHITECT'S ACTION

- A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:
 1. Final Unrestricted Release: When the Architect marks a submittal "Reviewed," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
 2. Final-But-Restricted Release: When the Architect marks a submittal "Approved as Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
 3. Returned for Resubmittal: When the Architect marks a submittal "Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

- a. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
- 4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."
- C. Unsolicited Submittals: The Architect will return unsolicited submittals to the sender without action.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01300

SECTION 01400 - QUALITY CONTROL**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 SUMMARY

- A. This Section includes administrative and procedural requirements for quality-control services.
- B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- E. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Cutting and Patching" specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.
 - 2. Division 1 Section "Submittals" specifies requirements for development of a schedule of required tests and inspections.

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
 - 1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will engage the services of a qualified independent testing agency to perform those services. Payment for these services will be made from the Inspection and Testing Allowance, as authorized by Change Orders.

- a. Where the Owner has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless agreed to in writing by the Owner.
 - B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.
 1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
 - C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
 1. Provide access to the Work.
 2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 4. Provide facilities for storage and curing of test samples.
 5. Deliver samples to testing laboratories.
 6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 7. Provide security and protection of samples and test equipment at the Project Site.
 - D. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
 1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
- 1.4 SUBMITTALS

- A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.

- h. Complete inspection or test data.
- i. Test results and an interpretation of test results.
- j. Ambient conditions at the time of sample taking and testing.
- k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
- l. Name and signature of laboratory inspector.
- m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

- A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.
 - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 01400

SECTION 01421 - REFERENCE STANDARDS AND DEFINITIONS**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 DEFINITIONS

- A. General: Basic contract definitions are included in the Conditions of the Contract.
- B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.
- D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 2. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding

generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.
 - a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.
- J. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the 16-division format and CSI/CSC's "MasterFormat" numbering system.
- B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.

- C. **Conflicting Requirements:** Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.
1. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
- D. **Copies of Standards:** Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- F. **Abbreviations and Names:** Trade association names and titles of general standards are frequently abbreviated. The following abbreviations and acronyms, as referenced in the Contract Documents, mean the associated names. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association 900 19th St., NW, Suite 300 Washington, DC 20006	(202) 862-5100
AABC	Associated Air Balance Council 1518 K St., NW, Suite 503 Washington, DC 20005	(202) 737-0202
AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173	(847) 303-5664
AAN	American Association of Nurserymen 1250 Eye St., NW, Suite 500 Washington, DC 20005	(202) 789-2900
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., NW Suite 249 Washington, DC 20001	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 One Davis Dr. Research Triangle Park, NC 27709-2215	(919) 549-8141
ABMA	American Bearing Manufacturers Association 1200 19th St., NW, Suite 300 Washington, DC 20036-2401	(202) 429-5155

ABMA	American Boiler Manufacturers Association 950 North Glebe Rd., Suite 160 Arlington, VA 22203-1824	(703) 522-7350
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333	(810) 848-3700
ACIL	American Council of Independent Laboratories 1629 K St., NW, Suite 400 Washington, DC 20006	(202) 887-5872
ACPA	American Concrete Pipe Association 222 West Las Colinas Blvd., Suite 641 Irving, TX 75039-5423	(214) 506-7216
ADC	Air Diffusion Council 11 South LaSalle St., Suite 1400 Chicago, IL 60603	(312) 201-0101
AEIC	Association of Edison Illuminating Companies 600 N. 18th St. P.O. Box 2641 Birmingham, AL 35291-0992	(205) 250-2530
AFBMA	Anti-Friction Bearing Manufacturers Association (Now ABMA)	
AFPA	American Forest and Paper Association 1111 19th St., NW, Suite 800 Washington, DC 20036	(202) 463-2700
AGA	American Gas Association 1515 Wilson Blvd. Arlington, VA 22209	(703) 841-8400
AHA	American Hardboard Association 1210 W. Northwest Hwy Palatine, IL 60067-1897	(847) 934-8800
AHAM	Association of Home Appliance Manufacturers 20 N. Wacker Dr., Suite 1500 Chicago, IL 60606	(312) 984-5800
AI	Asphalt Institute Research Park Dr. P.O. Box 14052 Lexington, KY 40512-4052	(606) 288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006-5292	(202) 626-7300
AIA	American Insurance Association 1130 Connecticut Ave., NW, Suite 1000	

	Washington, DC 20036	(202) 828-7100
AIHA	American Industrial Hygiene Association 2700 Prosperity Ave., Suite 250 Fairfax, VA 22031	(703) 849-8888
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001	(312) 670-2400
AISI	American Iron and Steel Institute 1101 17th St., NW Washington, DC 20036-4700	(202) 452-7100
AITC	American Institute of Timber Construction 7012 S. Revere Pkwy, Suite 140 Englewood, CO 80112	(303) 792-9559
ALA	American Laminators Association 1402 3rd Ave., Suite 709 Seattle, WA 98101-2118	(206) 682-3618
ALI	Associated Laboratories, Inc. P.O. Box 152837 1323 Wall St. Dallas, TX 75315	(214) 565-0593
ALSC	American Lumber Standards Committee P.O. Box 210 Germantown, MD 20875	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. 30 W. University Dr. Arlington Heights, IL 60004-1893	(847) 394-0150
ANSI	American National Standards Institute 11 West 42nd St., 13th Floor New York, NY 10036-8002	(212) 642-4900
AOAC	AOAC International 481 N. Frederick Ave., Suite 500 Gaithersburg, MD 20877	(301) 924-7077
AOSA	Association of Official Seed Analysts 201 N. 8th St., Suite 400 P.O. Box 81152 Lincoln, NE 68501-1152	(402) 476-3852
APA	APA-The Engineered Wood Association (Formerly American Plywood Association) P.O. Box 11700 Tacoma, WA 98411-0700	(206) 565-6600
API	American Petroleum Institute 1220 L St., NW Washington, DC 20005-8029	(202) 682-8000

ARI	Air-Conditioning and Refrigeration Institute 4301 Fairfax Dr., Suite 425 Arlington, VA 22203	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association 6000 Executive Dr., Suite 201 Rockville, MD 20852-3803	(301) 231-9050
ASA	Acoustical Society of America 500 Sunnyside Blvd. Woodbury, NY 11797	(516) 576-2360
ASC	Adhesive and Sealant Council 1627 K St., NW, Suite 1000 Washington, DC 20006-1707	(202) 452-1500
ASCE	American Society of Civil Engineers 345 East 47th St. New York, NY 10017-2398	(212) 705-7010
ASCE	American Society of Civil Engineers - World Headquarters 1801 Alexander Bell Dr. Reston, VA 20191-4400	(703) 295-6000
ASHE	American Society for Healthcare Engineering One North Franklin, Suite 2700 Chicago, IL 60606	(800) AHA-2626 (312) 422-3800
ASHRAE	American Society of Heating, Refrigerating and Air- Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329-2305	(800) 527-4723 (404) 636-8400
ASME	American Society of Mechanical Engineers 345 East 47th St. New York, NY 10017-2392	(800) 843-2763 (212) 705-7722
ASPA	American Sod Producers Association (Now TPI)	
ASPE	American Society of Plumbing Engineers 3617 Thousand Oaks Blvd., Suite 210 Westlake Village, CA 91362-3649	(805) 495-7120
ASSE	American Society of Sanitary Engineering P.O. Box 40362 Bay Village, OH 44140	(216) 835-3040
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959	(610) 832-9500

ATIS	Alliance for Telecommunications Industry Solutions 1200 G St., NW, Suite 500 Washington, DC 20005	(202) 628-6380
AWCI	Association of the Wall and Ceiling Industries--International 307 E. Annandale Rd., Suite 200 Falls Church, VA 22042-2433	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWI	Architectural Woodwork Institute 1952 Isaac Newton Sq. Reston, VA 20190	(703) 733-0600
AWPA	American Wood Preservers' Association P.O. Box 286 Woodstock, MD 21163-0286	(410) 465-3169
AWPB	American Wood Preservers' Bureau (This organization is now defunct.)	
AWS	American Welding Society 550 LeJeune Rd., NW Miami, FL 33126	(305) 443-9353
AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235	(303) 794-7711
BANC	Brick Association of North Carolina P.O. Box 13290 Greensboro, NC 27415-3290	(910) 273-5566
BHMA	Builders Hardware Manufacturers Association 355 Lexington Ave., 17th Floor New York, NY 10017-6603	(212) 661-4261
BIA	Brick Institute of America 11490 Commerce Park Dr. Reston, VA 22091-1525	(703) 620-0010
BIFMA	The Business and Institutional Furniture Manufacturer's Association 2680 Horizon Dr., SE, Suite A1 Grand Rapids, MI 49546-7500	(616) 285-3963
CAGI	Compressed Air and Gas Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
CAUS	Color Association of the United States 409 W. 44th St. New York, NY 10036-4402	(212) 582-6884

CBM	Certified Ballast Manufacturers Association 1422 Euclid Ave., Suite 402 Cleveland, OH 44115-2094	(216) 241-0711
CCC	Carpet Cushion Council P.O. Box 546 Riverside, CT 06878-0546	(203) 637-1312
CDA	Copper Development Association Inc. 260 Madison Ave., 16th Floor New York, NY 10016-2401	(800) 232-3282 (212) 251-7200
CFFA	Chemical Fabrics & Film Association, Inc. c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
CGA	Compressed Gas Association 1725 Jefferson Davis Hwy, Suite 1004 Arlington, VA 22202-4102	(703) 412-0900
CGSB	Canadian General Standards Board 222 Queen St., Suite 1402 Ottawa K1A 1G6 CANADA	(613) 941-8703
CISCA	Ceiling and Interior Systems Construction Association 1500 Lincoln Hwy, Suite 202 St. Charles, IL 60174	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Rd., Suite 419 Chattanooga, TN 37421	(615) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Suite 300 Columbia, MD 21046	(301) 596-2583
CPPA	Corrugated Polyethylene Pipe Association 4235 Monroe St., Suite 124 Toledo, OH 43606	(800) 510-2772
CRI	Carpet and Rug Institute P.O. Box 2048 Dalton, GA 30722-2048	(706) 278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Rd. Schaumburg, IL 60173-4758	(847) 517-1200
CSSB	Cedar Shake and Shingle Bureau 515 116th Ave., NE, Suite 275 Bellevue, WA 98004-5294	(206) 453-1323
CTI	Ceramic Tile Institute of America	

	12061 West Jefferson Blvd. Culver City, CA 90230-6219	(310) 574-7800
CTI	Cooling Tower Institute P.O. Box 73383 Houston, TX 77273	(713) 583-4087
DHI	Door and Hardware Institute 14170 Newbrook Dr. Chantilly, VA 22021-2223	(703) 222-2010
DIPRA	Ductile Iron Pipe Research Association 245 Riverchase Pkwy East, Suite O Birmingham, AL 35244	(205) 988-9870
DLPA	Decorative Laminate Products Association (Dissolved in 1995 - Now part of KCMA.)	
ECSA	Exchange Carriers Standards Association (Now ATIS)	
EIA	Electronic Industries Association 2500 Wilson Blvd. Arlington, VA 22201	(703) 907-7500
EIMA	EIFS Industry Members Association 402 N. Fourth St., Suite 102 Yakima, WA 98901-2470	(509) 457-3500
EJMA	Expansion Joint Manufacturers Association 25 N. Broadway Tarrytown, NY 10591	(914) 332-0040
ETL	ETL Testing Laboratories, Inc. c/o ITS/Warnock Hersey P.O. Box 2040 3933 U.S. Route 11, Industrial Park Cortland, NY 13045	(800) 345-3851 (607) 753-6711
FCI	Fluid Controls Institute P.O. Box 9036 Morristown, NJ 07960	(201) 829-0990
FCICA	Floor Covering Installation Contractors Association (Formerly Floor Covering Installation Board) P.O. Box 948 Dalton, GA 30722-0948	(706) 226-5488
FGMA	Flat Glass Marketing Association (Now GANA)	
FM	Factory Mutual 1151 Boston-Providence Tnpk. P.O. Box 9102 Norwood, MA 02062	(617) 762-4300

FTI	Facing Tile Institute P.O. Box 8880 Canton, OH 44711	(216) 488-1211
GA	Gypsum Association 810 First St., NE, Suite 510 Washington, DC 20002	(202) 289-5440
GANA	Glass Association of North America 3310 SW Harrison St. Topeka, KS 66611-2279	(913) 266-7013
GRI	Geosynthetic Research Institute 23rd and Lancaster Walk Rush Building, West Wing Philadelphia, PA 19104	(215) 895-2343
HEI	Heat Exchange Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
HI	Hydraulic Institute 9 Sylvan Way Parsippany, NJ 07054-3802	(201) 267-9700
HI	Hydronics Institute P.O. Box 218 35 Russo Pl. Berkeley Heights, NJ 07922	(908) 464-8200
HMA	Hardwood Manufacturers Association 400 Penn Center Blvd., Suite 530 Pittsburgh, PA 15235-5605	(412) 829-0770
HPVA	Hardwood Plywood and Veneer Association 1825 Michael Farraday Dr. P.O. Box 2789 Reston, VA 22090-0789	(703) 435-2900
IAS	International Approval Services 8504 East Pleasant Valley Road Cleveland, OH 44131	(216) 524-4990
IBD	Institute of Business Designers (Now part of IIDA)	
ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 440 South Yarmouth, MA 02664	(508) 394-4424
IEC	International Electrotechnical Commission (Available from ANSI) 11 West 42nd St., 13th Floor New York, NY 10036-8002	(212) 642-4900

IEEE	Institute of Electrical and Electronic Engineers 345 E. 47th St. New York, NY 10017-2394	(212) 705-7900
IESNA	Illuminating Engineering Society of North America 120 Wall St., 17th Floor New York, NY 10005-4001	(212) 248-5000
IGCC	Insulating Glass Certification Council c/o ETL Testing Laboratories, Inc. P.O. Box 2040 3933 U.S. Route 11, Industrial Park Cortland, NY 13045	(800) 345-3851 (607) 753-6711
IIDA	International Interior Design Association 341 Merchandise Mart Chicago, IL 60654-1104	(312) 467-1950
ILI	Indiana Limestone Institute of America Stone City Bank Building, Suite 400 Bedford, IN 47421	(812) 275-4426
IMSA	International Municipal Signal Association P.O. Box 539 165 E. Union St. Newark, NY 14513	(315) 331-2182
INCE	Institute of Noise Control Engineering P.O. Box 3206 Arlington Branch Poughkeepsie, NY 12603	(914) 462-4006
IRI	Industrial Risk Insurers P.O. Box 5010 85 Woodland St. Hartford, CT 06102-5010	(203) 520-7300
ISA	ISA - International Society for Measurement and Control P.O. Box 12277 67 Alexander Dr. Research Triangle Park, NC 27709	(919) 549-8411
KCMA	Kitchen Cabinet Manufacturers Association 1899 Preston White Dr. Reston, VA 22091-4326	(703) 264-1690
LIA	Lead Industries Association, Inc. 295 Madison Ave. New York, NY 10017	(212) 578-4750
LPI	Lightning Protection Institute 3365 N. Arlington Heights Rd., Suite E Arlington Heights, IL 60004-7700	(800) 488-6864 (847) 577-7200

MBMA	Metal Building Manufacturer's Association c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
MCAA	Mechanical Contractors Association of America 1385 Piccard Dr. Rockville, MD 20850-4329	(301) 869-5800
MFMA	Maple Flooring Manufacturers Association 60 Revere Dr., Suite 500 Northbrook, IL 60062	(847) 480-9138
MHI	Material Handling Institute (A Division of the Material Handling Industry) 8720 Red Oak Blvd., Suite 201 Charlotte, NC 28217-3992	(800) 345-1815 (704) 522-8644
MIA	Marble Institute of America 30 Eden Alley, Suite 201 Columbus, OH 43215	(614) 228-6194
MIA	Masonry Institute of America 2550 Beverly Blvd. Los Angeles, CA 90057	(213) 388-0472
ML/SFA	Metal Lath/Steel Framing Association (A Division of the NAAMM) 8 South Michigan Ave., Suite 1000 Chicago, IL 60603	(312) 456-5590
MRCA	Midwest Roofing Contractors Association 4840 W. 15th St., Suite 1000 Laurence, KS 66049	(913) 843-4888
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180-4602	(703) 281-6613
NAA	National Arborist Association P.O. Box 1094 Amherst, NH 03031-1094	(603) 673-3311
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Ave., Suite 1000 Chicago, IL 60603	(312) 456-5590
NAGDM	National Association of Garage Door Manufacturers c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
NAIMA	North American Insulation Manufacturers Association 44 Canal Center Plaza, Suite 310	

	Alexandria, VA 22314	(703) 684-0084
NAPA	National Asphalt Pavement Association NAPA Building 5100 Forbes Blvd. Lanham, MD 20706-4413	(301) 731-4748
NAPF	National Association of Plastic Fabricators (Now DLPA)	
NAPM	National Association of Photographic Manufacturers 550 Mamaroneck Ave. Harrison, NY 10528	(914) 698-7603
NBGQA	National Building Granite Quarries Association Inc. c/o Rock of Ages 369 N. State St. Concord, NH 03301	(800) 884-7936 (603) 225-8397
NBHA	National Builders Hardware Association (Now DHI)	
NCMA	National Concrete Masonry Association 2302 Horse Pen Rd. Herndon, VA 22071-3406	(703) 713-1900
NCPI	National Clay Pipe Institute P.O. Box 759 253-80 Center St. Lake Geneva, WI 53147	(414) 248-9094
NCRPM	National Council on Radiation Protection and Measurements 7910 Woodmont Ave., Suite 800 Bethesda, MD 20814-3095	(800) 229-2652 (301) 657-2652
NCSPA	National Corrugated Steel Pipe Association 1255 23rd St., NW, Suite 850 Washington, DC 20037	(202) 452-1700
NEBB	Natural Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877-4121	(301) 977-3698
NEC	National Electrical Code (Available from NFPA)	
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814-5372	(301) 657-3110
NEI	National Elevator Industry 185 Bridge Plaza North, Suite 310 Fort Lee, NJ 07024	(201) 944-3211

NELMA	Northeastern Lumber Manufacturers Association 272 Tuttle Rd. P.O. Box 87A Cumberland Center, ME 04021	(207) 829-6901
NEMA	National Electrical Manufacturers Association 2101 L St., NW, Suite 300 Washington, DC 20037	(202) 457-8400
NETA	InterNational Electrical Testing Association P.O. Box 687 Morrison, CO 80465-1526	(303) 697-8441
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101	(800) 344-3555 (617) 770-3000
NFPA	National Forest Products Association (Now AFPA)	
NFRC	National Fenestration Rating Council Incorporated 1300 Spring St., Suite 120 Silver Spring, MD 20910	(301) 589-NFRC
NHLA	National Hardwood Lumber Association P.O. Box 34518 Memphis, TN 38184-0518	(901) 377-1818
NKCA	National Kitchen Cabinet Association (Now KCMA)	
NLGA	National Lumber Grades Authority 103-4400 Dominion St. Burnaby, BC V5G 4G3 CANADA	(604) 451-7323
NOFMA	National Oak Flooring Manufacturers Association P.O. Box 3009 Memphis, TN 38173-0009	(901) 526-5016
NPA	National Particleboard Association 18928 Premiere Ct. Gaithersburg, MD 20879-1569	(301) 670-0604
NPCA	National Paint and Coatings Association 1500 Rhode Island Ave., NW Washington, DC 20005-5597	(202) 462-6272
NRCA	National Roofing Contractors Association O'Hare International Center 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018-5607	(847) 299-9070
NSF	NSF International	

	(Formerly National Sanitation Foundation) 3475 Plymouth Rd. P.O. Box 130140 Ann Arbor, MI 48113-0140	(313) 769-8010
NSSEA	National School Supply and Equipment Association 8300 Colesville Rd., No. 250 Silver Spring, MD 20910	(800) 395-5550 (301) 495-0240
NTMA	National Terrazzo and Mosaic Association 3166 Des Plaines Ave., Suite 121 Des Plaines, IL 60018	(800) 323-9736 (847) 635-7744
NUSIG	National Uniform Seismic Installation Guidelines 12 Lahoma Ct. Alamo, CA 94526	(510) 946-0135
NWMA	National Woodwork Manufacturers Association (Now NWWDA)	
NWWDA	National Wood Window and Door Association 1400 E. Touhy Ave., G-54 Des Plaines, IL 60018	(800) 223-2301 (708) 299-5200
PATMI	Power Actuated Tool Manufacturers' Institute, Inc. 1000 Fairgrounds Rd., Suite 200 St. Charles, MO 63301	(314) 947-6610
PCA	Portland Cement Association 5420 Old Orchard Rd. Skokie, IL 60077-1083	(847) 966-6200
PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Blvd. Chicago, IL 60604	(312) 786-0300
PDCA	Painting and Decorating Contractors of America 3913 Old Lee Hwy Fairfax, VA 22030	(703) 359-0826
PDI	Plumbing and Drainage Institute c/o William C. Whitehead 45 Bristol Drive, Suite 101 South Easton, MA 02375	(800) 589-8956 (508) 230-3516
PEI	Porcelain Enamel Institute 4004 Hillsboro Pike, Suite 224-B Nashville, TN 37215	(615) 385-5357
PPFA	Plastic Pipe and Fittings Association 800 Roosevelt Rd., Building C, Suite 20 Glen Ellyn, IL 60137-5833	(630) 858-6540

RCMA	Roof Coatings Manufacturers Association 6000 Executive Blvd., Suite 201 Rockville, MD 20852-3803	(301) 230-2501
RFCI	Resilient Floor Covering Institute 966 Hungerford Dr., Suite 12-B Rockville, MD 20850-1714	(301) 340-8580
RIS	Redwood Inspection Service c/o California Redwood Association 405 Enfrente Dr., Suite 200 Novato, CA 94949-7206	(415) 382-0662
RMA	Rubber Manufacturers Association 1400 K St., NW, Suite 900 Washington, DC 20005	(800) 220-7620 (202) 682-4800
SAE	SAE International 400 Commonwealth Dr. Warrendale, PA 15096-0001	(412) 776-4841
SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711-9502	(216) 493-7886
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145-1967	(216) 889-0010
SEFA	Scientific Equipment and Furniture Association 1028 Duchess Dr. McLean, VA 22101	(703) 790-8661
SEGD	Society of Environmental Graphic Designers 2700 Bridgeway Blvd. Sausalito, CA 94965	(617) 868-3781
SGCC	Safety Glazing Certification Council c/o ETL Testing Laboratories 3933 U.S. Route 11, Industrial Park P.O. Box 2040 Cortland, NY 13045	(800) 345-3851 (607) 753-6711
SHLMA	Southern Hardwood Lumber Manufacturers Association (Now HMA)	
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Ave. Chicago, IL 60611-4267	(312) 644-6610
SJI	Steel Joist Institute 1205 48th Ave. North, Suite A Myrtle Beach, SC 29577-5424	(803) 449-0487

SMA	Screen Manufacturers Association 2850 S. Ocean Blvd., Suite 114 Palm Beach, FL 33480-5535	(407) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association, Inc. 4201 Lafayette Center Dr. P.O. Box 221230 Chantilly, VA 22022-1209	(703) 803-2980
SPI	Society of the Plastics Industry, Inc. 1275 K St., NW, Suite 400 Washington, DC 20006	(202) 371-5200
SPIB	Southern Pine Inspection Bureau 4709 Scenic Hwy Pensacola, FL 32504-9094	(904) 434-2611
SPRI	SPRI (Formerly Single Ply Roofing Institute) 175 Highland Ave. Needham, MA 02194	(617) 444-0242
SSINA	Specialty Steel Industry of North America 3050 K St., NW, Suite 400 Washington, DC 20007	(800) 982-0355 (202) 342-8630
SSPC	Steel Structures Painting Council 40 24th St., 6th Floor Pittsburgh, PA 15222-4643	(412) 281-2331
SSPMA	Sump and Sewage Pump Manufacturers Association P.O. Box 647 Northbrook, IL 60065-0647	(847) 559-9233
STI	Steel Tank Institute 570 Oakwood Rd. Lake Zurich, IL 60047-1559	(847) 438-8265
SWI	Steel Window Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	(216) 241-7333
SWPA	Submersible Wastewater Pump Association 1806 Johns Dr. Glenview, IL 60025-1657	(798) 729-7972
SWRI	Sealant, Waterproofing and Restoration Institute 3101 Broadway, Suite 585 Kansas City, MO 64111	(816) 561-8230
TCA	Tile Council of America 100 Clemson Research Blvd.	

	Anderson, SC 29625	(864) 646-8453
TIMA	Thermal Insulation Manufacturers Association (Now NAIMA)	
TPI	Truss Plate Institute 583 D'Onofrio Dr., Suite 200 Madison, WI 53719	(608) 833-5900
TPI	Turfgrass Producers International (Formerly American Sod Producers Association) 1855-A Hicks Rd. Rolling Meadows, IL 60008	(847) 705-9898
UL	Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, IL 60062	(847) 272-8800
UNI-BELL	Uni-Bell PVC Pipe Association 2655 Villa Creek Dr., Suite 155 Dallas, TX 75234	(214) 243-3902
USGBC	United States Green Building Council 2101 L Street, NW Suite 500 Washington, DC 20037	(800) 795-1747
USP	U.S. Pharmacopeia (Formerly U.S. Pharmacopoeial Convention) 12601 Twinbrook Pkwy Rockville, MD 20852	(301) 881-0666
WA	Wallcoverings Association 401 N. Michigan Ave. Chicago, IL 60611-4267	(312) 644-6610
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281-3145	(503) 639-0651
WCMA	Window Covering Manufacturers Association (Formerly American Window Covering Manufacturers Association) 355 Lexington Ave., 17th Floor New York, NY 10017-6603	(212) 661-4261
WI	Woodwork Institute 3164 Industrial Blvd. P.O. Box 980247 West Sacramento, CA 95798-0247	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association P.O. Box 25278 Portland, OR 97225-0278	(503) 292-9288
WRI	Wire Reinforcement Institute	

	203 Loudoun St., SW Leesburg, VA 20175	(703) 779-2339
WSC	Water Systems Council Building C, Suite 20 800 Roosevelt Rd. Glen Ellyn, IL 60137	(630) 545-1762
WSFI	Wood and Synthetic Flooring Institute (Now MFMA)	
WWPA	Western Wood Products Association Yeon Building 522 SW 5th Ave. Portland, OR 97204-2122	(503) 224-3930

1.6 SUBMITTALS

- A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONSTRUCTION DOCUMENTS (DRAWINGS AND SPECIFICATIONS)

- A. The Contractor shall verify all dimensions on the drawings and site conditions prior to commencement of any work. The Architect shall be notified immediately, in writing, of all discrepancies between the drawings and the site conditions for a clarification or interpretation. In the absence of a clarification or interpretation, the Contractor shall bid, price or build the items in the higher cost or better quality condition shown anywhere on the plans and specifications.
- B. The Contractor shall provide all the work necessary for a complete, finished, weather-tight building structure with all systems in good working conditions regardless of details shown or omitted on these plans and specifications. All work shall conform to the minimum standards of the current edition of the applicable Building Code, and any other regulating agencies having authority over any portion of the work, including those codes and standards listed in these specifications.
- C. The Contractor shall hold the Architect harmless relieving from responsibility or liability for any damage or loss arising from any errors or omissions on these drawings and specifications, during bidding and construction. The intent of these drawings and specifications is to depict a complete, finished, weather-tight building structure with all systems in good working conditions, any obvious errors or omissions are not intentional and shall not be construed as a directive to the Contractor to build in such erroneous manner. The Architect shall be notified immediately, in writing, of any error or omission for a clarification or interpretation.
- D. Written dimensions shall take precedence over scaled pictograms shown on the drawings. Typical details and general notes are minimum requirements to be used when conditions are not shown otherwise.
- E. Specific notes and details on the drawings shall take precedence over general notes and typical details. Where no details are shown, construction shall conform to similar work on project.

- F. Approval by an inspector does not mean approval or failure to comply with the drawings and specifications. Any design which fails to be clear or is ambiguous must be referred to the Architect or his engineer for interpretation or clarifications.
- G. The design adequacy and safety of the erection, bracing, shoring, temporary supports, etc., shall be the sole responsibility of the Contractor. The Contractor shall be responsible for the stability of the structure prior to the application of all shear walls, roof and floor diaphragms and finish materials. The Contractor shall provide the necessary bracing to provide stability prior to the application of the aforementioned materials. Observation visits to the site by the Architect does not include inspection of the above items.
- H. The Architect shall not be responsible for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the work.
- I. The Architect does not guarantee the Contractor's performance, and no provisions of the contract documents shall relieve the Contractor from any liability due to negligence, incompetence, or errors or omissions or commissions of the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01421

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**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 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.

- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, and lights.
 - 3. Sidewalk bridge or enclosure fence for the site.
 - 4. Environmental protection.
 - 5. Video security cameras.

1.3 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

- B. Implementation and Termination Schedule: Within 15 days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, fire department, and rescue squad rules.
 - 5. Environmental protection regulations.

- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
 - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."
 - 1. For job-built temporary offices, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
 - 2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thicknesses indicated.
 - 3. For fences and vision barriers, provide minimum 3/8-inch- (9.5-mm-) thick exterior plywood.
 - 4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch- (16-mm-) thick exterior plywood.
- C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.
- D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary offices, shops, and sheds.
- E. Paint: Comply with requirements of Division 9 Section "Painting."
 - 1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
 - 2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
 - 3. For interior walls of temporary offices, provide 2 coats interior latex-flat wall paint.
- F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- G. Water: Provide potable water approved by local health authorities.

- H. Open-Mesh Fencing: Provide 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chainlink fabric fencing 6 feet (2 m) high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

2.2 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 - 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 - 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
 - 1. Install electric power service underground, except where overhead service must be used.
 - 2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
 - 1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

- F. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to the municipal system, as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
- G. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet (9 m) of building lines. Comply with requirements of NFPA 241.
- C. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
- D. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.
- E. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- F. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- G. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle

hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.
- B. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- C. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
 - 1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
 - 2. Security Video Cameras: Shall be added to view entire site.
- D. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01500

SECTION 01600 - MATERIALS AND EQUIPMENT**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 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
 - 2. Division 1 Section "Submittals" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
 - 3. Division 1 Section "Substitutions" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
 - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 SUBMITTALS

- A. Product List: Prepare a list showing products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
2. Form: Prepare product list with information on each item tabulated under the following column headings:
 - a. Related Specification Section number.
 - b. Generic name used in 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.
3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.
 - a. At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.
5. Architect's Action: The Architect will respond in writing to Contractor within 2 weeks of receipt of the completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.
6. Owner: Shall provide a list of Owner provided products:
 - a. Supplier.
 - b. Installer.
 - c. Projected delivery.

1.5 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
 1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. Confirm name with Construction Manager and Owner

prior to installation. The nameplate shall contain the following information and other essential operating data:

- a. Name of product and manufacturer.
- b. Model and serial number.
- c. Capacity.
- d. Speed.
- e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
 7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
 1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
 2. Semiproprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.

- a. Where Specifications specify products or manufacturers by name, accompanied by the term "or equal" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
3. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.
 - a. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
6. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
7. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
8. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.
9. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection and for procedures required for processing such selections.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

SECTION 01631 - SUBSTITUTIONS**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 SUMMARY

- A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
 - 2. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.
 - 3. Division 1 Section "Materials and Equipment" specifies requirements governing the Contractor's selection of products and product options.

1.3 DEFINITIONS

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
 - 1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
 - 2. Revisions to the Contract Documents requested by the Owner or Architect.
 - 3. Specified options of products and construction methods included in the Contract Documents.
 - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

- A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
 - 1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.

2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors, that will be necessary to accommodate the proposed substitution.
 - b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
 - c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
 - d. Samples, where applicable or requested.
 - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
 - h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
4. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.
 - a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Conditions: The Architect and Construction Manager will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
 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 request is timely, fully documented, and properly submitted.
 4. The specified product or method of construction cannot be provided within the Contract Time. The Architect and Construction Manager will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.

6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
 7. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
 9. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
 10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
 11. Where a proposed substitution involves more than one prime contractor, each contractor shall cooperate with the other contractors involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of products.
- B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01631

SECTION 01700 - CONTRACT CLOSEOUT**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 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Operation and maintenance manual submittal.
 - 4. Submittal of warranties.
 - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise the Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra stock, and similar items.
 - 7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
9. Complete final cleanup requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred, exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Architect will repeat inspection when requested and assured that the Work is substantially complete.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
5. Submit consent of surety to final payment.
6. Submit a final liquidated damages settlement statement.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
 2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
 3. Note related change-order numbers where applicable.
 4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
 3. Note related record drawing information and Product Data.
 4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.
1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
 2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
 3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.
- E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.
- G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch (51-mm), 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Maintenance manuals.
 2. Record documents.
 3. Spare parts and materials.
 4. Tools.
 5. Lubricants.
 6. Fuels.
 7. Identification systems.
 8. Control sequences.
 9. Hazards.
 10. Cleaning.
 11. Warranties and bonds.
 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Startup.
 2. Shutdown.
 3. Emergency operations.
 4. Noise and vibration adjustments.
 5. Safety procedures.
 6. Economy and efficiency adjustments.
 7. Effective energy utilization.

3.2 FINAL CLEANING

- A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 1 Section "Construction Facilities and Temporary Controls."
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
 1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 01700

SECTION 02060 - DEMOLITION**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Demolition and removal of buildings.
2. Demolition and removal of structures.
3. Demolition and removal of site improvements.
4. Disconnecting, capping or sealing, and abandoning site utilities in place.
5. Disconnecting, capping or sealing, and removing site utilities.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Cutting and Patching" for cutting and patching procedures for demolition operations.
2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures for demolition operations.
3. Division 1 Section "Contract Closeout" for record document requirements.
4. Division 2 Section "Site Clearing" for site clearing and removing above- and below-grade improvements.
5. Division 2 Section "Excavation" and "Grading" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.
- B. Historical items indicated remain the Owner's property. Carefully remove and salvage each item in a manner to prevent damage and deliver promptly to the Owner.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.
- B. Proposed dust-control measures.
- C. Proposed noise-control measures.
- D. Schedule of demolition activities indicating the following:
 - 1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
 - 2. Dates for shutoff, capping, and continuation of utility services.
- E. Inventory of items to be removed and salvaged.
- F. Inventory of items to be removed by Owner.
- G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by demolition operations.
- H. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."
 - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.
- I. Landfill records for record purposes indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Predemolition Conference: Conduct conference at Project site to comply with preinstallation conference requirements of Division 1 Section "Project Meetings."

1.7 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of Work.
- B. Owner assumes no responsibility for actual condition of buildings to be demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Asbestos: It is not expected that asbestos will be encountered in the course of this Contract. If any materials suspected of containing asbestos are encountered, do not disturb the materials. Immediately notify the Architect and the Owner.

1. Asbestos will be removed by Owner before start of Work.

D. Storage or sale of removed items or materials on-site will not be permitted.

1.8 SCHEDULING

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS (Not Applicable)

2.1 SOIL MATERIALS

A. Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when sufficient satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. Survey the condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.

E. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.

a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

- B. Owner will arrange for disconnecting and sealing indicated utilities serving structures to be demolished before start of demolition work, when requested by Contractor.
- C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving structures to be demolished.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
- D. Utility Requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.
- B. Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during demolition operations.
- C. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- E. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of buildings to be demolished and adjacent buildings to remain.
 - 1. Strengthen or add new supports when required during progress of demolition.

3.4 EXPLOSIVES

- A. Explosives: Use of explosives will not be permitted.

3.5 POLLUTION CONTROLS

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not create hazardous or objectionable conditions, such as ice, flooding, and pollution, when using water.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.
- C. Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

3.6 DEMOLITION

- A. Building Demolition: Demolish buildings completely and remove from the site. Use methods required to complete Work within limitations of governing regulations and as follows:
 1. Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 2. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
 3. Small buildings may be removed intact when permitted by Architect and approved by authorities having jurisdiction.
 4. Demolish concrete and masonry in small sections.
 5. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 6. Break up and remove concrete slabs on grade, unless otherwise shown to remain.
 7. Remove air-conditioning equipment without releasing refrigerants.
- B. Below-Grade Construction: Demolish foundation walls and other below-grade construction, as follows:
 1. Remove below-grade construction, including foundation walls, to at least 12 inches (300 mm) below grade.
 2. Remove below-grade construction, including foundation walls and footings, to the depths indicated.
 3. Completely remove below-grade construction, including foundation walls and footings.
 4. Break up and remove below-grade concrete slabs, unless indicated to remain.
 5. Break up below-grade concrete slabs into sections no larger than 24 inches (600 mm) square and leave in place.
- C. Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavements with soil materials according to requirements specified in Division 2 Section "Earthwork."
- D. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.

- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 02060

SECTION 02110 - SITE CLEARING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 2. Removal of trees and other vegetation.
 - 3. Topsoil stripping.
 - 4. Clearing and grubbing.
 - 5. Removing above-grade improvements.
 - 6. Removing below-grade improvements.

1.3 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.
 - 1. Protect improvements on adjoining properties and on Owner's property.
 - 2. Restore damaged improvements to their original condition, as acceptable to property owners.
- 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 (38 mm) 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.

1.4 EXISTING SERVICES

- A. General: Indicated locations are approximate; determine exact locations before commencing Work.

- B. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this Work.
- C. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
 - 1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
- B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches (100 mm). Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches (50 mm) in diameter, and without weeds, roots, and other objectionable material.
 - 1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 - 2. Dispose of unsuitable or excess topsoil as specified for disposal of waste material.
- C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
 - 1. Completely remove stumps, roots, and other debris protruding through ground surface.
 - 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 - 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches (150 mm) loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.
- D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.
 - 1. Abandonment or removal of certain underground tanks, pipes or conduits may be indicated on Civil, Mechanical or Electrical drawings and is included under work of related Division 15 and 16 Sections. Removing abandoned underground piping, conduits or tanks interfering with construction is included under this Section.

3.2 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning is not permitted on Owner's property.
- B. Removal from Owner's Property: Remove waste materials and unsuitable or excess topsoil from Owner's property.

END OF SECTION 02110

SECTION 02282 - TERMITE CONTROL**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes soil treatment for termite control.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data and application instructions.
- C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.
- B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.
- C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 JOB CONDITIONS

- A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.
- B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

- A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If

subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

- B. Warranty Period: 5 years from date of Substantial Completion.
- C. 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.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

- A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Chloropyrifos:
 - a. Dursban TC, Dow Chemical Co.
 - 2. Permethrin:
 - a. Dragnet FT, FMC Corp.
 - b. Torpedo, ICI Americas, Inc.
 - 3. Cypermethrine:
 - a. Prevail FT, FMC Corp.
 - b. Demon, ICI Americas, Inc.
 - 4. Fenvalerate:
 - a. Gold Coast Tribute, Du Pont.
 - 5. Isofenphose:
 - a. Pryfon, Mobay Corp.
- D. Dilute with water to concentration level recommended by manufacturer.
- E. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.
- B. Application Rates: Apply soil treatment solution as follows:
 - 1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:
 - a. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
 - b. Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallon of chemical solution per 10 sq. ft. (6.1 L of chemical solution per sq. m) to areas where fill is washed gravel or other coarse absorbent material.
 - c. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench for each 12 inches (300 mm) of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches (150 to 200 mm) wide along outside of foundation to a depth of not less than 12 inches (300 mm). Punch holes to top of footing at not more than 12 inches (300 mm) o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.
- C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.
- D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION 02282

Section 31 2200

Grading

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough grading the site for site structures and building pads.
- B. Finish grading .

1.02 RELATED REQUIREMENTS

- A. Section 31 2316 - Excavation.
- B. Section 31 2323 - Fill: Filling and compaction.
- C. Geotechnical Report prepared by Geo-Advantec dated February 15, 2016.

PART 2 PRODUCTS

2.01 MATERIALS

- A. 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.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.

3.03 ROUGH GRADING

- A. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- C. When excavating through roots, perform work by hand and cut roots with sharp axe.
- D. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

- A. Stockpile excavated topsoil on site.
- B. Stockpile subsoil to be re-used on site; remove remainder from 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. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).

- D. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

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.

3.08 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

Excavation

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating for building volume below grade, footings, slabs-on-grade, paving, and site structures.
- B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Geotechnical Report prepared by Geo-Advantec dated February 15, 2016.
- B. Section 31 2200 - Grading: Grading.
- C. Section 31 2323 - Fill: Fill materials, filling, and compacting.

PART 3 EXECUTION

2.01 EXAMINATION

2.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.
- C. Locate, identify, and protect utilities that remain and protect from damage.
- D. Notify utility company to remove and relocate utilities.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

2.03 EXCAVATING

- A. Over-excavate as follows: . Over excavation shall be backfilled with imported structural fill.
 - 1. 3 feet below bottom of footings within building envelopes and 5 feet beyond outer faces of footings.
 - 2. 2 feet below buried tanks extending 3 feet beyond the outer face of tank.
 - 3. 1 foot below pedestrian and vehicular site paving.
- B. Over excavation shall be backfilled with imported structural fill compacted to a minimum of 90% dry density per ASTM D1557.
- C. Excavate to accommodate new structures and construction operations.
- D. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- E. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.
- F. Do not interfere with 45 degree bearing splay of foundations.
- G. Cut utility trenches wide enough to allow inspection of installed utilities.
- H. Hand trim excavations. Remove loose matter.
- I. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.
- J. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- K. Remove excavated material that is unsuitable for re-use from site.

- L. Remove excess excavated material from site.

2.04 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

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. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Geotechnical Report prepared by Geo-Advantec dated February 15, 2016.
- B. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.
- C. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

- A. 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; 2010.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. 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.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- G. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

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, including manufactured fill.
- D. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. Structural Fill: Imported borrow.
 - 1. Graded.

2. Expansion Index less than 30.
 3. Free of organic materials, debris, and cobbles larger than 3 inches.
 4. No more that 25% of the materials shall be larger than 2 inches and no more than 40% shall pass the #200 sieve.
 5. Compact to minimum 90% dry density per ASTM D1557.
 6. Structural Fill shall be approved by the Geotechnical Consultant.
- B. Sand Bedding of Pipe: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.02 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, non-woven, Mirafi 140N.

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. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.

3.02 PREPARATION

- A. Scarify subgrade surface to a depth of 12 inches (____ mm) to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Structural 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. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. 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.
- F. Correct areas that are over-excavated.
1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 90 percent of maximum dry density.
 2. Other areas: Use structural fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- G. Compaction Density Unless Otherwise Specified or Indicated:

1. Under paving, slabs-on-grade, and similar construction: 90 percent of maximum dry density.
- H. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FILL AT SPECIFIC LOCATIONS

- A. Structural Fill:
1. Fill up to subgrade elevations.
 2. Maximum depth per lift: 8 inches (200 mm), compacted.
 3. Compact to minimum 90 percent of maximum dry density.

3.05 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.

3.06 FIELD QUALITY CONTROL

- A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D3017, or ASTM D6938.
- B. 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.
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- D. Provide at least the following tests to the Geotechnical Engineer for approval:
1. At paved areas, at least one field density test for every 2,000 square feet of paved area, but not less than three tests.
 2. In each compacted fill layer, one field density test for every 2,000 square feet of overlaying paved , but not less than three tests.
- E. Proof roll compacted fill at surfaces that will be under slabs-on-grade, pavers, and paving.

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.

1.03 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 1965 (2004).
- B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- E. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. 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.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Coarse Aggregate Type II: Coarse aggregate, conforming to State of California Highway Department standard.
- B. Aggregate: 3/4 inch crushed washed stone; free of shale, clay, friable material and debris.
- C. Geotextile Fabric: Non-biodegradable, non-woven, Geotextile;140N manufactured by Mirafi or approved equal.

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. If tests indicate materials do not meet specified requirements, change material and retest.
- D. 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. Place aggregate in maximum 4 inch (100 mm) layers and roller compact to specified density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

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.
- 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.

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. Surface sealer.

1.02 RELATED REQUIREMENTS

- A. Section 32 1123 - Aggregate Base Courses: Aggregate base course.
- B. Section 32 1723.13 - Painted Pavement Markings: Concrete bumpers.

1.03 REFERENCE STANDARDS

- A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; 1997.
- B. AI MS-19 - A Basic Asphalt Emulsion Manual; Fourth Edition.
- C. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with State of California Highways standard.
- B. Mixing Plant: Conform to State of California Highways standard.
- C. Obtain materials from same source throughout.

1.05 FIELD CONDITIONS

- A. Do not place asphalt when ambient air or base surface temperature is less than 50 degrees F (____ degrees C), or surface is wet or frozen.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: ASTM D946.
- B. Aggregate for Base Course: In accordance with State of California Highways standards.
- C. Primer: In accordance with State of _____ Highways standards.
- D. Tack Coat: Homogeneous, medium curing, liquid asphalt.
- E. Seal Coat: AI MS-19, fog type.

2.02 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. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.
- C. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.03 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).
- C. Apply tack coat to contact surfaces of curbs, gutters and _____.
- D. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with State of California 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 SEAL COAT

- A. Apply seal coat to surface course in accordance with AI MS-19.

3.07 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.

3.08 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for 7 days or until surface temperature is less than 140 degrees F (60 degrees C).

End of Section

Section 32 1313
Concrete Paving

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks, integral curbs, gutters, and parking areas.

1.02 RELATED REQUIREMENTS

- A. Section 31 2200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- B. Section 31 2323 - Fill: Compacted subbase for paving.
- C. Section 32 1123 - Aggregate Base Courses: _____ base course.
- D. Section 32 1726 - Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

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; 2010 (Errata 2012).
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- D. ACI 305R - Hot Weather Concreting; 2010.
- E. ACI 306R - Cold Weather Concreting; 2010.
- F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- H. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- J. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- K. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.
- L. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- M. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- N. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- O. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

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.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Wood form material, profiled to suit conditions.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751).
 - 1. Thickness: 1/2 inch (12 mm).

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 80 (80,000 psi) (550 MPa) yield strength; deformed billet steel bars; unfinished.
- B. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi (280 MPa) yield strength; deformed billet steel bars; unfinished finish.

2.03 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C150/C150M, Air Entraining - Type IIA Portland cement, grey or as indicated on plans color.
- C. Fine and Coarse Mix Aggregates: ASTM C33/C33M.

2.04 ACCESSORIES

- A. Tactile Warning Surfaces: See Section 32 1726.

2.05 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. Concrete Properties:
 - 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 2500 psi (_____ MPa).

2.06 MIXING

- A. 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

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 as indicated.
- B. Place dowels to achieve pavement and curb alignment as detailed.
- C. Provide doweled joints 18 inch (____ mm) on center at transverse joints.

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. Place concrete using the slip form technique.
- D. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

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.
- C. Provide scored joints.
 - 1. At 3 feet (1 m) intervals.
 - 2. Between sidewalks and curbs.
 - 3. Between curbs and pavement.

3.09 FINISHING

- A. Area Paving: Light broom, texture perpendicular to pavement direction.
- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius (6 mm radius).
- C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
- D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

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.

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 for 7 days minimum after finishing.

End of Section

Section 32 1713
Parking Bumpers

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precast concrete parking bumpers and anchorage.

1.02 REFERENCE STANDARDS

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- B. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- C. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- D. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2014.

1.03 SUBMITTALS

- A. Product Data: Provide unit configuration, dimensions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Parking Bumpers: Precast concrete, conforming to the following:
 - 1. Nominal Size: 6 inches (___ mm) high, 8 inches (___ mm) wide, 6 feet (___ m) long.
 - 2. Cement: ASTM C150/C150M, Portland Type I - Normal; white color.
 - 3. Concrete Materials: ASTM C330/C330M aggregate, water, and sand.
 - 4. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size commensurate with precast unit design.
 - 5. Air Entrainment Admixture: ASTM C260/C260M.
 - 6. Concrete Mix: Minimum 5,000 psi (34 MPa) compressive strength after 28 days, air entrained to 5 to 7 percent.
 - 7. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
 - 8. Embed reinforcing steel, and drill or sleeve for two dowels.
 - 9. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
 - 10. Minor patching in plant is acceptable, providing appearance of units is not impaired.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install units without damage to shape or finish. Replace or repair damaged units.
- B. Install units in alignment with adjacent work.
- C. Fasten units in place with 2 dowels per unit.

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.
- C. "No Parking" curb painting.

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; Rev. D, 2007.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.
- C. 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.

1.05 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.

1.06 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

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. 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.
- C. 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.

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. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- 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.
- 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 the 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. Length Tolerance: Plus or minus 3 inches (75 mm).
 - 4. 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.

1.03 REFERENCE STANDARDS

- A. 49 CFR 37 - Transportation Services for Individuals with Disabilities (ADA); current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method; 2007e1.
- E. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2014.
- F. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).
- G. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
- H. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2010.
- I. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2010.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- K. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way; 2011.

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. 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.
 - 2. ADA Solutions, Inc; _____: www.adatile.com.
 - 3. Armor-Tile, a brand of Engineered Plastics, Inc; _____: www.armortiletransit.com.
 - 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. Pattern: In-line pattern of truncated domes complying with ADA Standards.

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.

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. If existing conditions are not as required to properly complete the work of this section, notify Architect.
 - 2. 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, 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.

3.03 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.

3.04 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 33 0513
Manholes and Structures

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).
- B. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2015.

1.03 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.

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: Per City Standards.
- C. Concrete Reinforcement: As indicated.

2.02 COMPONENTS

- A. Lid and Frame: ASTM A48/A48M, Class 30B Cast iron construction, machined flat bearing surface, removable lid, closed lid design; H-20 Rated ____ psf (____ kPa) lid molded with identifying name.

2.03 CONFIGURATION

- A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female quick set grout joints; sleeved to receive pipe sections.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: 48 inch (1,200 mm) diameter.
- D. Design Depth: As indicated.
- E. Clear Lid Opening: As indicated.

PART 3 EXECUTION

3.01 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. Cut and fit for pipe.
- D. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

- E. Set cover frames and covers level without tipping, to correct elevations.
- F. Coordinate with other sections of work to provide correct size, shape, and location.

End of Section

Section 33 1116

Site Water Utility Distribution Piping

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 and Domestic water hydrants.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete for thrust restraints.
- B. Section 31 2316 - Excavation: Excavating of trenches.
- C. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- D. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCES

- A. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- B. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- C. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.
- D. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.
- E. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).
- F. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 1998 (Reapproved 2011).
- G. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
- H. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.
- I. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges; 2011.
- J. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.
- K. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; 2009.
- L. AWWA C504 - Rubber-Seated Butterfly Valves 3 In. (75 mm) Through 72 In. (1,800 mm); 2010.
- M. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2009.
- N. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; 2010.
- O. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2007.
- P. UL 246 - Hydrants for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 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. Names and addresses of the nearest service and maintenance organization that readily stocks repair parts.
- E. Manufacturer's recommended installation procedures.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with City requirements.
- B. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Ductile Iron Pipe: AWWA C151:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with rods.
 - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.
- B. 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.
- C. PVC Pipe: C900, Class 200.
 - 1. Fittings: ASTM D2466, PVC.
 - 2. Joints: ASTM D2855, solvent weld.
- D. 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.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- 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.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.03 HYDRANTS

- A. Hydrants: Type as required by the City.

2.04 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 2316.13.
- B. Cover: As specified in Section 31 2316.13.

2.05 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03 3000.
- B. Backflow Preventer: As indicated on plans and approved by Agencies.
- C. Meter: As indicated on plans and approved by Agencies.

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. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

- A. Install ductile iron piping and fittings to AWWA C600.
- B. Route pipe in straight line.
- C. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- D. Slope water pipe and position drains at low points.
- E. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 2316.13.

3.05 INSTALLATION - VALVES AND HYDRANTS

- A. Set valves on solid bearing soil.
- 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.

3.06 SERVICE CONNECTIONS

- A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves.

3.07 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Closing un-inspected work:
 - 1. Do not allow or cause any of the work of this Section to be covered up or enclosed until after it has been completely inspected and tested, and has been approved by the Engineer.
- C. Hydrostatic tests:
 - 1. Where any section of a water line is provided with concrete thrust blocking for fittings, do not make hydrostatic tests until at least five days after installation of the concrete thrust blocking, unless otherwise directed by the Engineer.

2. Devise a method for disposal of wastewater from hydrostatic tests, and for disinfection, as approved in advance by the Engineer.
 3. Backfill and compaction shall be completed prior to the final 2-hour pressure test.
 4. Each section of the pipe to be tested shall be slowly filled with water, and all air shall be expelled from the pipe.
 - a. The release of the air can be accomplished by opening hydrants and service cocks at the high points of the system and the blowoffs at all dead ends.
 - b. The valve controlling the admission of water into the section of pipe to be tested shall be opened wide before shutting the hydrants or blowoffs.
 - c. After the system has been filled with water and all air expelled, all the valves controlling the section to be tested shall be closed.
 - d. The line shall be allowed to set for a period of not less than 24 hours.
 - e. The pipe shall then be refilled, if necessary, prior to the pressure tests.
- D. Pressure tests:
1. Bring newly laid piping and valved sections of water distribution and service piping to a hydrostatic pressure of 200 psi for two hours.
 2. Open and close each valve several times during the test.
 3. Carefully examine exposed pipe, joints, fittings, and valves.
 4. Replace or remake joints showing visible leakage.
 - a. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings, and valves. Replace with sound material and repeat the test until results are satisfactory.
 - b. Make repair and replacement without additional cost to the Owner.
- E. Leakage test:
1. Conduct leakage test after the pressure test has been completed satisfactorily.
 2. Duration of each leakage test: Minimum two (2) hours.
 3. During the test, subject water lines to a pressure of 200 psi.
 4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
 - a. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:
 - 1) $L = 0.00304 ND \times \text{sq. root of } P$
 - 2) ($L = 0.00054 ND \times \text{sq root of } P$); where
 - 3) L = allowable leakage in gallons per hour;
 - 4) N = number of joints in length of pipe under test;
 - 5) D = nominal diameter of pipe in inches; and
 - 6) P = average test pressure in lbs per sq inch.
 - 7) The allowable leakage in gallons per hour, per joint, at 200 psi average test pressure shall be in accordance with Table II.
 - 8) Should any test of pipe disclose leakage greater than that specified in Table II, locate and repair the defective joint or joints until the leakage is within the specified allowance, and at no additional cost to the Owner.
 - b. Table II:
 5. Diameter:Leakage in gal:Diameter: Leakage in gal:
 - a. $0.015312''0.0915$
 - b. $0.023114''0.1070$
 - c. $0.030616''0.1225$

- d. 0.045818”0.1375
- e. 0.061020”0.1530
- f. 0.076524”0.1830

F. Time for making test:

- 1. Except for joint material setting, or where concrete reaction backing necessitates a five day delay, pipelines jointed with rubber gaskets, mechanical, or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill.

G. Disinfection:

- 1. Disinfect per Section 02515 - Disinfection of Water Distribution System.

End of Section

Section 33 1300

Disinfecting of Water Utility Distribution

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of site domestic water lines and site fire water lines specified in Section 33 1116.

1.02 RELATED REQUIREMENTS

- A. Section 33 1116 - Site Water Utility Distribution Piping.

1.03 REFERENCE STANDARDS

- A. AWWA B300 - Hypochlorites; 2011.
- B. AWWA B301 - Liquid Chlorine; 2010.
- C. AWWA B302 - Ammonium Sulfate; 2010.
- D. AWWA B303 - Sodium Chlorite; 2010.
- E. AWWA C651 - Disinfecting Water Mains; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Test Reports: Indicate results comparative to specified requirements.
- C. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.
- D. 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.
- E. 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 City.

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 governing authorities of the State in which the Project is located.
- C. Submit bacteriologist's signature and authority associated with testing.

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.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system 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.

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

Section 33 3111

Site Sanitary Utility Sewerage Piping

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage drainage piping, fittings, and accessories.
- B. Connection of building sanitary drainage system to municipal sewers.
- C. Sand-Oil Interceptors, Grease Interceptor, Holding Tank, and Water Storage Tank.

1.02 RELATED REQUIREMENTS

- A. Section 31 2316 - Excavation: Excavating of trenches.
- B. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

- A. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- B. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.
- C. 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. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Project Record Documents:
 - 1. Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Plastic Pipe: Poly Vinyl Chloride (PVC), SDR 26, bell and spigot style solvent sealed joint end.
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

- A. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service" in large letters.

2.03 BEDDING AND COVER MATERIALS

- A. Pipe Bedding Material: As specified in Section 31 2316.13.
- B. Pipe Cover Material: As specified in Section 31 2316.13.

2.04 SAND OIL SEPERATORS

- A. Approved Products:
 - 1. Jensen Precast Model JZ4000SO 4000 Gallon Sand-Oil Interceptor

2. Jensen Precast Model JP500SO 500 Gallon Sand Oil Interceptor
- B. H-20 rated tank, frame, and cover.
- C. Contractor to verify inlet and outlet diameter and inverts on plans and coordinate with precast manufacturer.
- D. Contractor to provide all materials and labor to install per manufacturer's recommendations including excavation, preparation, bedding, installation, connection, backfill, and compaction.

2.05 GREASE INTERCEPTOR

- A. Approved Products:
 1. Endura XL100 Grease Interceptor
- B. H-20 rated tank, frame, and cover.
- C. Contractor to verify inlet and outlet diameter and inverts on plans and coordinate with precast manufacturer.
- D. Contractor to provide all materials and labor to install per manufacturer's recommendations including excavation, preparation, bedding, installation, connection, backfill, and compaction.

2.06 HOLDING TANK

- A. Approved Products:
 1. Jensen KHP2000 (HP2000) 2000 Gallon Holding Tank.
- B. H-20 rated tank, frame, and cover.
- C. Contractor to verify inlet and outlet diameter and inverts on plans and coordinate with precast manufacturer.
- D. Contractor to provide all materials and labor to install per manufacturer's recommendations including excavation, preparation, bedding, installation, connection, backfill, and compaction.

2.07 WATER STORAGE TANK

- A. Approved Products:
 1. Xerxes 2,000 gallon, single wall fiberglass, 6 foot diameter.
- B. H-20 rated.
- C. Contractor to verify inlet and outlet diameter and inverts on plans and coordinate with precast manufacturer.
- D. Contractor to provide all materials and labor to install per manufacturer's recommendations including excavation, preparation, bedding, installation, connection, backfill, and compaction.

2.08 OTHER MATERIALS

- A. Sewer Cleanouts: Per City Standards.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 31 2316.13 for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 - 1. Plastic Pipe: Also comply with ASTM D2321.
- C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).
- D. Connect to building sanitary sewer outlet .
- E. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 2316.13.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.04 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

End of Section

Section 33 4111

Site Storm Utility Drainage Piping

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.
- B. Catch basins, Trench drains, Paved area drainage, Site surface drainage, and Floor Drains.
- C. Underground detention system, pump station, and biofiltration system.

1.02 RELATED REQUIREMENTS

- A. Section 31 2316 - Excavation: Excavating of trenches.
- B. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

- A. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- B. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.
- C. ASTM F-405/f-667 - Corrugated polyethylene tubing and fittings.
- D. AASHTO M252 - Specification for Corrugated Polyethylene Drainage Tubing, 3- to 10- inch Diameter.
- E. AASHTO M294 - Specification for Corrugated Polyethylene Pipe, 12- to 36- Inch Diameter.
- F. ASTM D1056 - Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. ASTM D1248 - Specification for Polyethylene Plastics Molding and Extrusion Material.
- H. ASTM D3350 - Specification for Polyethylene Plastics Pipe and Fittings Materials.
- I. ASTM D2321 - Standard practice for underground installation.

1.04 SUBMITTALS

- A. Comply with pertinent provisions of Division 01 - General Requirements – Administrative Requirements.
- B. Product data: Within 35 calendar days after the Contractor has received the City's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the work.

1.05 PRODUCT HANDLING

- A. Comply with pertinent provisions of Division 01 - General Requirements - Product Requirements

1.06 SUBMITTALS

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

- B. Product Data: Provide data indicating pipe, pipe accessories, and other items in this specification.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- E. Project Record Documents:
 - 1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 STORM WATER DRAINAGE PIPE MATERIALS

- A. Provide pipe and associated materials of the size indicated on the Drawings and meeting the following requirements.
 - 1. High Density Polypropylene Pipe (PDPP):
 - a. Acceptable products:
 - 1) "HP Storm" pipe and fittings manufactured by Advanced Drainage Systems, Inc., 4640 Trueman Blvd., Hilliard, OH 43026. Phone (800) 821-6710.
 - 2) Approved Equal.
 - 2. High Density Polypropylene Pipe material shall comply with:
 - a. AASHTO M330.
 - b. ASTM F2881 for fittings.
- B. Plastic Pipe: ASTM D1785, Schedule 40, Poly Vinyl Chloride (PVC) material; inside nominal diameter of up to 12 inches (____ mm), bell and spigot style solvent sealed joint end.

2.02 PIPE ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.03 CATCH BASIN, TRENCH DRAIN, CLEANOUT, AND AREA DRAIN COMPONENTS

- A. General:
 - 1. Construct manholes, inlets, and junction structures of reinforced concrete or precast reinforced concrete, complete with metal frames and covers or gratings, and with fixed ladder rungs where indicated on the Drawings or required by codes. Prefabricated structures may be used when shown on the plans and approved by the engineer.
 - 2. Rungs shall be individual wall-mounted aluminum, plastic-covered steel, or galvanized steel rungs are acceptable.
- B. Materials:
 - 1. Concrete: Comply with provisions for 3,250 psi concrete specified in Section 02750 Concrete Pavement.
 - 2. Mortar for pipe joints and connections to other drainage structures, and manhole construction.
 - a. Comply with requirements of ASTM C270, type M, except the maximum placement time shall be one hour.
 - b. Hydrated lime complying with ASTM C141, type B, may be added to the mixture of sand and cement in an amount equal to 25% of the volume of cement used.

- c. Provide a quantity of water in the mixture sufficient to produce a stiff workable mortar, which shall be clean and free from harmful acids, alkalis, and organic impurities. Use the mortar within 30 minutes after water is added to the mix.
3. Precast reinforced concrete manholes:
 - a. Comply with ASTM C478, precast rings and cone sections.
 - b. Fully bed the joints between precast concrete risers and tops in mortar, and smooth both interior and exterior surfaces uniformly.
 - c. Acceptable products:
 - 1) Manufactured by Ameron Pipe Products Group, El Monte, California.
 - 2) Manufactured by Santa Rosa Cast Products Company, 471 West College Avenue, Santa Rosa, CA 95401. Phone: (707) 546-5016, Fax: (707) 571-7768.
 - 3) Manufactured by Associated Concrete Products, Inc., 4301 W. Mac Arthur Boulevard, Santa Ana, CA 92704. Phone: (800) 862-6465, Fax: (714)540-0538.
 - 4) Approved equivalent.
4. Reinforcement: Provide intermediate grade billet steel complying with ASTM A 615, grade 40.
5. Frames and covers or gratings:
 - a. Provide all gratings or covers from the same manufacturer.
 - b. Provide standard black finish, supplied as a total unit, sized as shown on the Drawings or larger sizes except where in a pavement area, and with the wording "STORM DRAIN" cast into the cover.
 - c. Acceptable products:
 - 1) Manufactured by Alhambra Foundry, Alhambra, California.
 - 2) Approved equivalent.
6. Precast concrete catch basins:
 - a. Provide reinforced and bottom open for field pouring to ensure slope through the structure.
 - b. Contractor may select this option in lieu of cast-in-place concrete catch basins.
 - 1) Acceptable products:
 - 2) Manufactured by Christy, 44100 Christy Street, Fremont, CA 94538. Phone: (800) 486-7070, Fax: (510) 490-6804.
 - 3) Manufactured by Central Precast Concrete Inc., 471 West College Avenue, Santa Rosa, CA 95401. Phone: (707) 546-5016, Fax: (707) 571-7768.
 - 4) Manufactured by Brooks Products, 1850 Parco Avenue, Ontario, CA 91761. Phone: (888) 307-7470, Fax: (909) 947-7741.
 - 5) Approved equivalent.

2.04 IN-LINE DRAINS

- A. The inline drain shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The pipe bell spigot shall be joined to the inline drain body by use of a swage mechanical joint. The pipe stock used to manufacture the inline drain body and pipe bell spigot of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings; ASTM F1336, Standard for PVC Gasketed Sewer Fittings.

- B. The grates furnished for all surface drainage inlets shall be ductile iron grates for sizes 8", 10", 18", 24" and 30" (12" and 15" frames are cast iron) shall be made specifically for each fitting so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Inline drain grates for traffic loading areas and turf areas shall be flat and capable of supporting H-20 wheel loading for heavy-duty traffic. Grates in shrub and planter areas shall be domed and capable of a minim H-10 loading for pedestrian traffic. Grates in 12" and 15" will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron and ASTM A-48-83 Class 30B for 12" and 15" cast iron frames. Grates shall be provided painted black.
- C. Acceptable Product:
1. Model ADS 27XXAG N, manufactured by Advanced Drainage Systems, 4640 Trueman Boulevard, Hilliard, OH 43026. Phone: (800) 821-6710, Fax: (614) 658-0204.
 2. Drain-Rite, manufactured by Hancor, 6106 North Prospect, Fresno, CA 93711. Phone: (559) 435-6680, Fax: (559) 435-6667.
 3. Approved equal.

2.05 UNDERGROUND DETENTION SYSTEM

- A. Storage System Requirements:
1. 800 LF of 60 inch inside diameter water tight, corrosion resistant detention system.
 2. Double gasketed joints.
 3. Inserta Tee connections.
 4. 24" Access Risers at each end of each run of pipe.
 5. Caltrans Class II Aggregate Base bedding and backfill to 6 inches above pipe crown.
 6. Nonwoven filter fabric to isolate bedding and backfill from native soil, bottom, sides, and top.
 7. 50 year warrantee.
 8. Contractor to provide stamped engineering plans for review by engineer.
 9. Contractor to provide and install all required pipes, parts, fittings, bedding, backfill, and appurtenances as required by manufacturer.

2.06 STORMWATER PUMP STATION

- A. Package pump station including supply, delivery, installation, and commissioning of all manholes, foundations, piping, risers, access frames and grates, wiring, power service, control panel, level sensors, pumps, valves, and appurtenances.
- B. With two pumps capable of discharging 0.09 cfs thru a 2" discharge and 0.34 cfs thru a 3" discharge.
- C. 4 foot diameter wetwell with anti-flotation base.
- D. Contractor to submit stamped engineering plans to engineer for approval.

2.07 STORMWATER BIOFILTRATION SYSTEM

- A. Acceptable Products:
1. Modulare Wetlands MWS - L-8-12-V
- B. Contractor to provide and install system including base, backfill, all piping, filters, planting medium, plants as recommended by manufacturer and approved by landscape architect, and irrigation system.

2.08 TRENCH DRAIN SYSTEM

- A. Acceptable Products:

1. EZ-Track manufactured by NDS.
 2. Dura Slope manufactured by NDS.
 3. Approved Equal
- B. Grates: Minimum H-20 Load Rated Ductile Iron.
- C. Contractor to provide all labor, materials, trench drains, grates, inlets, outlets, end caps, fittings, grates, concrete, reinforcement, forms, stakes, as recommended by manufacturer to complete the system.

2.09 FLOOR DRAIN

- A. Acceptable Products:
1. Zurn Z4115B Polished Nickel Bronze.
 2. Approved Equal.
- B. 6 inch diameter strainer.
- C. 4 inch diameter outlet pipe.
- D. Contractor to provide all materials and labor to install per manufacturer recommendations.

2.10 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 2316.13.
- B. Cover: As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the work.
- C. Do not proceed until unsatisfactory conditions are corrected.

3.02 TRENCHING

- A. See Section 31 2316.13 for additional requirements.
- B. Excavate, trench, and bed for site drains as follows:
- C. Movement of construction machinery:
1. Use means necessary to avoid displacement of, and injury to, pipe and structure while compacting by rolling or operating equipment parallel to the pipe.
 2. Movement of construction machinery over a culvert or storm drain at any stage of construction is solely at the Contractor's risk.
- D. Bedding:
1. Provide a bedding surface for the pipe with a firm foundation of uniform density throughout the entire length of the pipe.
 2. Bed the pipe carefully in a soil foundation accurately shaped and rounded to conform to the lower $\frac{1}{4}$ of the outside perimeter of circular pipe, or set the pipe in a bed of sand.
 3. Tamp bedding where necessary.
 4. Provide bell holes and depressions for pipe joints of only the length, depth, and width required for making the particular pipe joint properly.
 5. Where plastic pipe is used, provide a minimum of 4" of sand bedding over the top and under the pipe.

3.03 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. General:
 - 1. Carefully examine each pipe prior to placing.
 - a. Promptly set aside defective pipe and damaged pipe.
 - b. Clearly identify defects.
 - c. Do not install defective pipe or damaged pipe.
 - 2. Place pipe to the grades and alignment indicated, with a tolerance of one in 1000 vertical and one in 500 horizontal, unless otherwise directed by the Architect.
 - 3. Provide adequate facilities for lowering pipe safely into the trenches.
 - 4. Do not place pipe in water, nor place pipe when trench or weather is unsuitable for such work.
- C. Polyvinyl chloride pipe joints: Install with the specified materials and in accordance with the manufacturer's recommendations as approved by the Engineer, applying solvent cement to pipe and fitting as recommended in ASTM D285.
- D. High Density Polyethylene: Installation shall be in accordance with ASTM D2321 and as recommended by the pipe manufacturer. Backfill shall be ASTM D2321 Class I, II, or III soils, or USCS material corresponding to these ASTM designations. Backfill material shall be placed in 6-inch lifts and compacted to 90 percent minimum density per AASHTO T99.
- E. Joining pipes of different materials: Provide fittings or couplings made for the pipe material joining, or provide a concrete collar as approved by the Engineer.
- F. Joining pipe of different sizes:
 - 1. Provide reducer fittings to the larger pipe.
 - 2. Where pipes are different materials as well as different sizes, use the same material for reducer fittings as in the larger pipe.
 - 3. Use saddle connection when branch lines join a main or collector main.
 - 4. Use eccentric collar joint when the slope of the pipe is less than 1%.
- G. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 - 1. Plastic Pipe: Also comply with ASTM D2321.
- H. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).
- I. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

3.04 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection in accordance with Division 01 - General Requirements.

- B. Visually inspect the pipe for deflection.
1. Deflection is limited to 7.5% of the base diameter.
 2. If the visual inspection determines the pipe may have deflection problems, the engineer can direct a mandrel test be performed.
 3. Such test will be performed at the contractor's expense.
 4. If required, the procedure can be conducted within the first 30 days after installation. Recommended mandrel settings reflecting 7.5% of the base diameter for pipe are shown in the table below:

NOMINAL DIAMETER INCHES	PIPE MEETING ASTM AND AASHTO STANDARDS	MANDREL SETTING INCHES	PIPE MEETING CSA STANDARDS	MANDREL SETTING MM
	BASE DIAMETER INCHES		BASE DIAMETER MM	
4	3.87	3.58	96.92	89.7
6	5.80	5.36	145.42	134.5
8	7.73	7.15	193.84	179.3
10	9.66	8.94	242.34	224.2
12	11.60	10.73	290.83	269.0
15	14.50	13.41	363.65	336.4
18	17.40	16.09	436.18	403.5
21	20.30	18.78	508.86	470.7
24	23.20	21.46	581.67	538.0
Pipe size greater than 24" is tested by visual inspection				

- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.06 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

End of Section

SECTION 03300 - CAST-IN-PLACE CONCRETE**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
- B. Cast-in-place concrete includes the following:
 - 1. Foundations and footings.
 - 2. Slabs-on-grade.
 - 3. Fill for steel pan stairs.
 - 4. Fountains.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 2 Section "Portland Cement Concrete Paving" for concrete paving and walks.
 - 2. Division 5 Section "Steel Deck" for steel deck construction.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.

- C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
 2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 REINFORCING MATERIALS

- A. As indicated on Structural Drawings.

2.3 CONCRETE MATERIALS

- A. As indicated on Structural Drawings.

2.4 RELATED MATERIALS

- A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217- inch- (0.46-mm-) thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick (0.76 mm) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
- C. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.
- D. Vapor Barrier: Premolded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic antistick sheet. Water vapor transmission rate of 1 perm when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.
1. Product: Subject to compliance with requirements, provide Sealtight Premoulded Membrane by W.R. Meadows, Inc.

2.5 PROPORTIONING AND DESIGNING MIXES

- A. As indicated on Structural Drawings.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
 - 1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
 - 1. Provide Class A tolerances for concrete surfaces exposed to view.
 - 2. Provide Class C tolerances for other concrete surfaces.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
 - 1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. 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.

3.4 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least 1-1/2 inches (38 mm) deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

- F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."
- G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth, unless otherwise indicated.
1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
 3. If joint pattern is not shown, provide joints not exceeding 15 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
 4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.5 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 3. Maintain reinforcing in proper position on chairs during concrete placement.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.
1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.
1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
 2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 MONOLITHIC SLAB FINISHES

- A. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
 - 1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- B. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.10 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
- D. Provide moisture curing by the following methods:
 - 1. Keep concrete surface continuously wet by covering with water.

3.11 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

END OF SECTION 03300

SECTION 03350 – CONCRETE FINISHING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Finishing concrete slabs and formed surfaces.
 2. Floor sealer.
 3. Stained concrete finish.
- B. Related Sections:
1. Division 3 Sections, Concrete.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
1. 301 - Structural Concrete for Buildings.
 2. 302.1 - Guide for Concrete Floor and Slab Construction.
- B. ASTM International (ASTM):
1. C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 2. E1155 - Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System (Inch-Pound Units).

1.3 DEFINITIONS

- A. Specified Overall Value (SOV): Describes the flatness or levelness value which must be achieved when all measured values of that type on a given Test Surface are combined.
- B. Minimum Local Value (MLV): Describes the flatness or levelness value below which repair or replacement is required and applies to Minimum Local Area.
- C. Minimum Local Area (MLA): An area bounded by construction or contraction joints or by column lines or half-column lines, whichever is smaller; no boundary crosses a construction joint or expansion joint.
- D. Level: Horizontal, normal to the direction of gravity. An envelope is defined by 2 level lines which are separated by stated distances.

1.4 SUBMITTALS

- A. Submittals for Review:
1. Product Data: Descriptive data for concrete stain.

2. Samples: 12 x 12 inch stained concrete samples.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 3 years' experience in work of this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Concrete Colorants:
 1. Bomanite Corp. (www.bomanite.com)
 2. Davis Colors. (www.daviscolors.com)
 3. L.M. Scofield Co., Inc. (www.scofield.com)
 4. Solomon Colors. (www.solomoncolors.com)
- B. Acceptable Manufacturers - Concrete Stains:
 1. Endurable Concrete Products. (www.endurableproducts.com)
 2. H and C Concrete Stains. (www.hc-concrete.com)
 3. Kemiko Concrete Stains. (www.kemiko.com)
 4. L.M. Scofield Co., Inc. (www.scofield.com)
- C. Acceptable Manufacturers - Concrete Sealers:
 1. BASF Corporation. (www.buildingsystems.basf.com)
 2. Dayton Superior Corporation. (www.daytonsuperior.com)
 3. W. R. Meadows, Inc. (www.wrmeadows.com)
 4. Nox-Crete Products Group. (www.nox-crete.com)
- D. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Concrete Materials: Specified in Division 3.
- B. Concrete Stain:
 1. Source: Color to be selected from manufacturer's full color range.
- C. Floor Sealer/Hardener:
 1. Type: Water soluble, inorganic silicate based.

2.3 MIXES

- A. Patching Mortar:
 1. Use same proportions as concrete except omit coarse aggregate.
 2. Add minimum water required for handling and placing.

PART 3 - EXECUTION

3.1 FINISHING FORMED SURFACES

- A. Concealed Surfaces: Leave texture imparted by forms.
- B. Exposed Surfaces:
 - 1. While concrete is still green, patch voids over 1/2 inch in diameter or depth.
 - 2. Chip away defective concrete; form edges perpendicular to surface. Wet area to be patched with clean water.
 - 3. Apply bonding agent in accordance with manufacturer's instructions.
 - 4. Press mortar into place; strike off slightly higher than surrounding surface. Allow initial shrinkage to occur before finishing.
 - 5. Finish to match texture and color of adjacent surfaces.
 - 6. Remove fins and other protrusions by rubbing with carborundum stone while concrete is still green.

3.2 FINISHING INTERIOR FLOOR SURFACES

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.
- B. Steel trowel and stain surfaces.
 - 1. Apply stain in accordance with manufacturer's instructions, to uniform coverage.
 - 2. Work stain into surface voids.
 - 3. Prevent overlaps, application patterns, and streaks.
 - 4. Apply color curing compound in accordance with manufacturer's instructions, to uniform coverage.
- C. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot.
- D. Tolerances:
 - 1. Maximum variation of surface flatness for exposed concrete floors: 1/8 inch in 10 feet.
 - 2. Correct defects by grinding or removal and replacement of defective work. Re-measure corrected areas by same process.

3.3 FINISHING EXTERIOR SLAB SURFACES

- A. Finish concrete slab surfaces in accordance with ACI 301.
- B. Steel trowel and broom finish surfaces.
- C. Steel trowel and stain surfaces.
 - 1. Apply stain in accordance with manufacturer's instructions, to uniform coverage.
 - 2. Work stain into surface voids.
 - 3. Prevent overlaps, application patterns, and streaks.
 - 4. Apply color curing compound in accordance with manufacturer's instructions, to uniform coverage.

D. Tolerances:

1. Maximum variation of surface flatness: 1/4 inch in 10 feet.
2. Correct defects by grinding or removal and replacement of defective work. Re-measure corrected areas by same process.

END OF SECTION 03350

SECTION 04200 - UNIT MASONRY**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Concrete unit masonry.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Flashing and Sheet Metal" for exposed sheet-metal flashing installed in masonry.
 - 2. Division 7 Section "Joint Sealants" for sealing joint in mockup.
 - 3. Division 9 Section "Portland Cement Plaster".

1.3 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.
 - 1. For Concrete Unit Masonry: As follows, based on net area:
 - a. f'm = 1500 psi (10.3 MPa).

1.4 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 different masonry unit, accessory, and other manufactured product specified.
- C. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.
- D. Samples for initial selection of the following:
 - 1. Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
- B. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Concrete Masonry Units:
 - a. Angelus Block Co., Inc.
 - b. Orco Block and Hardscape
 - 2. Portland Cement, Mortar Cement, Masonry Cement, and Lime:
 - a. Essroc Materials, Inc.
 - b. Glen-Gery Corporation.
 - c. Lafarge Corporation.
 - d. Lehigh Portland Cement Co.

- e. Riverton Corporation (The).
3. Joint Reinforcement, Ties, and Anchors:
 - a. Dur-O-Wal, Inc.
 - b. Heckman Building Products, Inc.
 - c. Hohmann & Barnard, Inc.
 - d. Masonry Reinforcing Corp. of America.
 - e. National Wire Products Industries.
 - f. Southern Construction Products.

2.2 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows for each form of concrete masonry unit required.
 1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 2. Provide square-edged units for outside corners, except where indicated as bullnose.
- B. Concrete Masonry Units: ASTM C 90 and as follows:
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength indicated below:
 - a. 1900 psi (13.1 MPa).
 2. Weight Classification: Normal weight.
 3. Aggregates: Do not use aggregates made from pumice, scoria, or tuff.. Provide Type I, moisture-controlled units.
 4. Size: Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sizes indicated on Drawings:
 - a. 6 inch (150 mm) nominal: 5-5/8 inch (143 mm) actual.
 - b. 8 inch (200 mm) nominal: 7-5/8 inch (194 mm) actual.
 5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
 6. Type: Provide "precision" masonry units.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Masonry Cement: ASTM C 91.
- D. Hydrated Lime: ASTM C 207, Type S.
- E. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm), use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.
- F. Aggregate for Grout: ASTM C 404.

- G. Water: Potable.

2.4 REINFORCING STEEL

- A. Steel Reinforcing Bars: Material and grade as follows:
 - 1. Billet steel complying with ASTM A 615 (ASTM A 615M).
- B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.
- C. Welded-Wire Fabric: ASTM A 185.

2.5 JOINT REINFORCEMENT

- A. General: Provide joint reinforcement formed from the following:
 - 1. Galvanized carbon-steel wire, coating class as follows:
 - a. ASTM A 641 (ASTM A 641M), Class 1, for interior walls; and ASTM A 153, Class B-2, for exterior walls.

2.6 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated.
- B. Wire: As follows:
 - 1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
 - 2. Wire Diameter: 0.1875 inch (4.8 mm).

2.7 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.

- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.
- B. Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to the opening.
- C. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- D. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

3.3 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arrises, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), nor 3/8 inch in 20 feet (10 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch in 40 feet (12 mm in 12 m) or more. For top surface of bearing walls, do not exceed 1/8 inch (3 mm) in 10 feet (3 m), nor 1/16 inch (1.5 mm) within width of a single unit.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
 - 1. As indicated on Drawings.
- D. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set

masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.

- E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
 - 4. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch (10-mm) joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.6 HORIZONTAL-JOINT REINFORCEMENT

- A. General: Provide continuous horizontal-joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcing a minimum of 6 inches (150 mm).
 - 1. Space reinforcement not more than 16 inches (406 mm) o.c.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

3.7 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.
- E. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

END OF SECTION 04200

SECTION 05400 - COLD-FORMED METAL FRAMING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior load-bearing steel-stud walls.
 - 2. Interior load-bearing steel-stud walls.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Division 9 Section "Gypsum Board Assemblies" for gypsum board and nonload-bearing metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. AISI "Specifications": Calculate structural characteristics of cold-formed metal framing according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and the following:
 - 1. Center for Cold-Formed Steel Structures (CCFSS) Technical Bulletin, Vol. 2, No. 1, February 1993 "AISI Specification Provisions for Screw Connections."
- C. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the following minimum physical and structural properties:
 - 1. Physical and Structural Properties: As indicated.
- D. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
 - 1. Design Loads: As indicated.

1.4 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. Shop drawings showing layout, spacings, sizes, thicknesses, and types of cold-formed metal framing, fabrication, fastening and anchorage details, including mechanical fasteners. Show

reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachments to other units of Work.

1. For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."
 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.6 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

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated in the Work include, but are not limited to, the following:
 1. Alabama Metal Industries Corp.
 2. American Studco, Inc.
 3. Angeles Metal Systems.
 4. California Metal Systems, Inc.
 5. Clark-Cincinnati, Inc.
 6. Consolidated Fabricators Corp.
 7. Consolidated Systems, Inc.
 8. Dale//Incor Industries of Florida.
 9. Dale Industries, Inc.
 10. Design Shapes in Steel.
 11. Dietrich Industries, Inc.
 12. Incor Plant Dale Industries.

13. Knorr Steel Framing Systems.
14. MarinoWare; Div. of Ware Industries, Inc.
15. Studco of Hawaii, Inc.
16. Super Stud Building Products, Inc.
17. Unimast, Inc.
18. United Construction Supply.
19. United States Steel.
20. Western Metal Lath Co.

2.2 MATERIALS

- A. Galvanized-Steel Sheet: ASTM A 446 (ASTM A 446M), zinc coated according to ASTM A 525 (ASTM A 525M), and as follows:
 1. Coating Designation: G 60 (Z 180).
 2. Grade: As required by structural performance.

2.3 WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depths indicated, with lipped flanges, and complying with the following:
 1. As indicated on Structural Drawings.

2.4 JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched, of web depths indicated, with lipped flanges, and complying with the following:
 1. As indicated on Structural Drawings.

2.5 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 (230 MPa).
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Gusset plates.
 5. Deflection track and vertical slide clips.
 6. Stud kickers and girts.
 7. Joist hangers and end closures.
 8. Reinforcement plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36 (ASTM A 36M), zinc coated by the hot-dip process according to ASTM A 123.
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); 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 ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.7 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.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. 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, with fluid consistency and a 30-minute working time.
- D. Thermal Insulation: ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

2.8 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. Fabricate framing assemblies in jig templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted.
 - 4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying 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-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
 5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to manufacturer's recommendations.
- 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 (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

3.1 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.

3.2 PREPARATION

- A. Before sprayed-on fireproofing is applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed-on fireproofing.
- B. After sprayed-on fireproofing has been applied, remove only as much fireproofing as needed to complete installation of cold-formed framing without reducing thickness of fireproofing below that required to obtain fire-resistance rating indicated. Protect remaining fireproofing from damage.
- C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 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 tying 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 (1:960) and as follows:
 1. 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.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings recommended by the manufacturer, but not greater than the following:
 1. Spacing: 24 inches (610 mm) for nail or power-driven anchors.
- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track. Space studs as follows:
 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Align studs vertically where wall-framing continuity is interrupted by floor framing. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align joists over studs. Where joists cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

- G. Install headers over wall openings wider than the stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
1. Frame wall openings with not less than a double stud at each jamb of frame as indicated or required by manufacturer.
 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
1. Where type of supplementary support is not indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced in rows not more than 48 inches (1219 mm) apart. Fasten at each stud intersection.
1. Bridging: Cold-rolled steel channel, clip angle fastened to webs of punched studs.
 2. Bridging: Flat, steel-sheet straps of width and thickness indicated, fastened to stud flanges.
 3. Bridging: Combination of flat, steel-sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
- J. Install steel-sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom track. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 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 ASTM 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 05400

SECTION 05500 - METAL FABRICATIONS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following metal fabrications:

- 1. Rough hardware.
- 2. Ladders (including elevator pit ladders).
- 3. Miscellaneous framing and supports for the following:
 - a. Overhead doors.
 - b. Applications where framing and supports are not specified in other sections.
- 3. Miscellaneous steel trim, including the following:
 - a. Steel angle corner guards.
- 4. Pipe bollards.
- 5. Ledger supports at car wash building pits.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

- 1. Division 5 Section "Metal Stairs" for metal framed stairs with metal pan, metal plate, or grating treads.
- 2. Division 5 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railing systems.

1.3 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 nonslip aggregates and nonslip aggregate surface finishes, prefabricated building columns, cast nosings, treads and thresholds, steel floor plate, paint products, and grout.
- C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel," AWS D1.2 "Structural Welding Code--Aluminum," and AWS D1.3 "Structural Welding Code--Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).
- C. Rolled Steel Floor Plates: ASTM A 786 (ASTM A 786M).
- D. Steel Tubing: Product type (manufacturing method) and as follows:
 - 1. Cold-Formed Steel Tubing: ASTM A 500.
 - 2. Hot-Formed Steel Tubing: ASTM A 501.
 - a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.
- E. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
 - 1. Galvanized finish for exterior installations and where indicated.
- F. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27 (ASTM A 27M) cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

- G. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.2 ALUMINUM

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T6.
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632 (ASTM B 632M) Pattern 1, alloy 6061-T6.

2.3 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.4 FASTENERS

- A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.
- C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).
- D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).
- E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.
- F. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).
- G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).
- I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

2.5 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
1. Nonshrink, Nonmetallic Grouts:
 - a. B-6 Construction Grout; W. R. Bonsal Co.
 - b. Diamond-Crete Grout; Concrete Service Materials Co.
 - c. Supreme; Cormix Construction Chemicals.
 - d. Sure-grip High Performance Grout; Dayton Superior Corp.
 - e. Euco N-S Grout; Euclid Chemical Co.
 - f. Five Star Grout; Five Star Products.
 - g. Vibropruf #11; Lambert Corp.
 - h. Crystex; L & M Construction Chemicals, Inc.
 - i. Masterflow 928 and 713; Master Builders Technologies, Inc.
 - j. Sealtight 588 Grout; W. R. Meadows, Inc.
 - k. SonogROUT 14; Sonneborn Building Products--ChemRex, Inc.
 - l. Kemset; The Spray-Cure Company.

2.6 CONCRETE FILL

- A. Concrete Materials and Properties: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless higher strengths are indicated.

2.7 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100 deg F (55.5 deg C).
 - D. Shear and punch metals cleanly and accurately. Remove burrs.
 - E. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - F. Remove sharp or rough areas on exposed traffic surfaces.
 - G. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
 - H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
 - I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
 - K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
 - L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- 2.8 ROUGH HARDWARE
- A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.
 - B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.
- 2.9 STEEL LADDERS
- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details, and anchorages as indicated. Comply with requirements of ANSI A14.3.

- B. Siderails: Continuous, steel, 1/2-by-2-1/2-inch (12-by-64-mm) flat bars, with eased edges, spaced 18 inches (460 mm) apart.
- C. Bar Rungs: 3/4-inch- (19-mm-) diameter steel bars, spaced 12 inches (300 mm) o.c.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points spaced not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
 - 1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches (180 mm).
 - 2. Extend side rails 42 inches (1.1 m) above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.
- F. Provide nonslip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, or by using a type of manufactured rung that is filled with aluminum-oxide grout.
- G. Galvanize ladders, including brackets and fasteners, in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 - a. Except as otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.
- C. Galvanize miscellaneous framing and supports in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.11 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.

- B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.
- C. Galvanize miscellaneous steel trim in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.12 PIPE GUARDS

- A. Provide pipe guards of 3-by-3-by-5/16-inch (76-by-76-by-8-mm) steel angles, extending from floor to 42 inches (1100 mm) above floor. Provide with 3/8-inch (10-mm) steel base plates for bolting to floor, and with 1/4-by-2-inch (6.4-by-50-mm) steel strap braces at top. Provide at least 2 vertical angles at each location, except at internal corners, and extend strap between angles and from each angle to wall or column.

2.13 PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 80 steel pipe. Cap bollards with 1/4-inch (6.4-mm) minimum steel plate.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve.

2.14 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.
- B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

- A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
 - 1. ASTM A 153 for galvanizing iron and steel hardware.
 - 2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise

indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.
- C. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.3 INSTALLING PIPE BOLLARDS

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
- B. Fill bollards solidly with concrete, mounding top surface.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a 2.0-mil (0.05-mm) minimum dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 Section "Painting."
- C. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05510 - METAL STAIRS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Straight run, steel-framed stairs.
 - 2. Steel pipe handrails and railing systems attached to metal stairs.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Division 5 Section "Pipe and Tube Railings" for pipe handrails and railing systems, not attached to metal stairs or to walls adjacent to metal stairs.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer, fabricate, and install steel stairs to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of steel stairs.
 - 1. Treads of Steel Stairs: Capable of withstanding a uniform load of 100 lbf per sq. ft. (4.8 kN/sq. m) or a concentrated load of 300 lbf (1.35 kN) on a area of 4 sq. inches (26 sq. cm) located in the center of the tread, whichever produces the greater stress.
 - 2. Platforms of Steel Stairs: Capable of withstanding a uniform load of 100 lbf per sq. ft. (4.8 kN/sq. m).
 - 3. Stair Framing: Capable of withstanding stresses resulting from loads specified above as well as stresses resulting from railing system loads.
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on the following:
 - 1. Testing performed according to ASTM E 894 and E 935.
 - 2. Structural computations.
- C. Structural Performance: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each of the respective components of each metal fabrication.
 - 1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:

- a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
- a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot (730 N/m) applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to one sq. ft. (0.09 sq. m) at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.
- a. Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress on guard.

1.4 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 metal stairs, prefilled metal pan stair treads, nonslip aggregates and nonslip aggregate surface finishes, cast nosings, extruded nosings, steel floor plate, paint products, and grout.
- C. Shop drawings detailing fabrication and installation of steel stairs. Include plans, elevations, sections, and details of steel stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
 1. For installed steel stairs indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.
- D. Samples for initial selection of the following products, in the form of manufacturer's color charts or sections of units showing the full range of colors and patterns.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing steel stairs similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.
- B. Installer Qualifications: Arrange for steel stair installation specified in this Section by the same firm that fabricated them.
- C. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of metal stairs (including handrails and railing systems) similar to this Project in material, design, and extent and that have a record of successful in-service performance.

- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."
1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering preassembled stair units that may be incorporated in the Work include, but are not limited to, the following:
1. Alfab, Inc.
 2. American Metal Works, Inc.
 3. American Stair Corp., Inc.
 4. The Sharon Companies, Ltd.

2.2 FERROUS METALS

- A. Metal Surfaces, General: For surfaces exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, roughness, or, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
- B. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).
- C. Steel Tubing: Product type (manufacturing method) and as follows:
1. Cold-Formed Steel Tubing: ASTM A 500.
 - a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.
- D. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
2. Galvanized finish for exterior installations and where indicated.
- E. Rolled Steel Floor Plate: ASTM A 786 (ASTM A 786M).
- H. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade as follows:
1. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:
 - a. Grade A, unless otherwise indicated or required by design loading.
- I. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:

1. Cold-Rolled Steel Sheet: ASTM A 366 (ASTM A 366M).
2. Hot-Rolled Steel Sheet: ASTM A 569 (ASTM A 569M).

J. Galvanized Steel Sheet: Quality as follows:

- 2
1. Commercial Quality: ASTM A 526 (ASTM A 526M), G 90 (Z 275) coating designation, unless otherwise indicated.

K. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.3 FASTENERS

- A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head type, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.
- C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).
- D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).
- E. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).
- F. Lock Washers: Helical, spring type, carbon steel, ANSI B 18.21.1.
- G. Expansion Anchors: Anchor bolt and sleeve assemblies of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).

2.4 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

2.5 CAST ABRASIVE NOSINGS

- A. Fabricate units of material, sizes, and configurations indicated. If not indicated, provide cast-iron units with integral abrasive finish. Furnish in lengths required to accurately fit each opening or conditions.
 - 1. Cast units with an integral abrasive grit consisting of aluminum oxide, silicon carbide, or a combination of both.
- B. 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. American Safety Tread Co., Inc.
 - 2. Amstep Products.
 - 3. Armstrong Products, Inc.
 - 4. Balco/Metalines, Inc.
 - 5. Safe-T-Metal Co.
 - 6. Wooster Products Inc.
- D. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.

2.7 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Nonshrink, Nonmetallic Grouts:
 - a. B-6 Construction Grout; W. R. Bonsal Co.
 - b. Diamond-Crete Grout; Concrete Service Materials Co.
 - c. Supreme; Cormix Construction Chemicals.
 - d. Sure-grip High Performance Grout; Dayton Superior Corp.
 - e. Euco N-S Grout; Euclid Chemical Co.
 - f. Five Star Grout; Five Star Products.
 - g. Vibropruf #11; Lambert Corp.
 - h. Crystex; L&M Construction Chemicals, Inc.
 - i. Masterflow 928 and 713; Master Builders Technologies, Inc.
 - j. Sealtight 588 Grout; W. R. Meadows, Inc.
 - k. SonogROUT 14; Sonneborn Building Products--ChemRex, Inc.
 - l. Kemset; The Spray-Cure Company.

2.8 CONCRETE FILL AND REINFORCING MATERIALS

- A. Concrete Materials and Properties: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 2,500 psi (17 MPa), unless higher strengths indicated.
- B. Nonslip Aggregate Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rust-proof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

- C. Reinforcing Bars: ASTM A 615, Grade 60 (ASTM A 615M), Grade 400), unless otherwise indicated.

2.10 FABRICATION, GENERAL

- A. Form steel stairs from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Shear and punch metals cleanly and accurately.
- D. Remove sharp or rough areas on exposed surfaces.
- E. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- H. Shop Assembly: Preassemble in shop to greatest extent possible to minimize field splicing and assembly. Use connections that maintain structural value of joined pieces. Clearly mark units for field assembly and coordinated installation.
- I. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.11 STEEL-FRAMED STAIRS

- A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, handrails, railing systems, newels, balusters, struts, clips, brackets, bearing plates, or other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.
 - 1. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for class of stair designated, except where more stringent requirements are indicated.
 - a. Commercial class, unless otherwise indicated.

- b. Architectural class where indicated.
2. Fabricate treads and platforms of exterior stairs to accommodate slopes to drain in finished traffic surfaces.
- B. Stair Framing: Fabricate stringers of structural steel channels, plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; and bolt or weld newels and framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finish surfaces.
1. Where masonry walls support steel stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Risers, Subtreads, and Subplatforms: Shape metal pans for risers and subtreads to conform to configuration shown. Provide thicknesses of structural steel sheet for metal pans indicated, but not less than that required, to support total design loading.
1. Form metal pans of uncoated cold-rolled steel sheet, unless otherwise indicated.
 3. Form metal pans of galvanized-steel sheet, where indicated.
 4. Directly weld risers and subtreads to stringers; locate welds on side of metal pans to be concealed by concrete fill.
 5. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 6. Shape metal pans to include nosing integral with riser.
 7. Attach cast abrasive nosings to pan risers. Make nosings full width of tread with noses flush with riser faces and tread surfaces.
 8. Attach extruded abrasive nosings to pan risers. Make nosings full width of tread with noses flush with riser faces and tread surfaces.
 9. At Contractor's option, provide prefabricated stair assemblies with prefilled treads consisting of prepoured reinforced concrete fill, with nonslip aggregate finish, in welded sheet metal pan, attached to installed stringers using manufacturer's standard connection detail.
 11. Provide subplatforms of configuration and construction indicated; if not indicated, of same metal as risers and subtreads, in thicknesses required to support design loading. Attach subplatform to platform framing members with welds.
- E. Steel Floor Plate Treads and Platforms: Provide abrasive surface floor plate.
1. Abrasive Surface Floor Plate: Manufacturer's standard abrasive granules, rolled into surface of steel plate. Provide material with coefficient of friction (COF) of 0.6 or higher when tested according to ASTM C 1028.
 2. Form treads of 1/4-inch- (6-mm-) thick steel floor plate with integral nosing and back edge stiffener. Weld steel supporting brackets to stringers and weld treads to brackets.
 3. Fabricate platforms of floor plate of thickness indicated. Provide nosing matching that on treads at all landings. Secure to platform framing members with welds.
- F. Floor Grating Treads and Platforms: Provide patterns, spacing, and bar sizes indicated; fabricate to comply with ANSI/NAAMM MBG 531 "Metal Bar Grating Manual."
1. Fabricate treads from welded steel grating with 1-1/4-by-3/16-inch (32-by-4.8-mm) bearing bars at 15/16 inch (24 mm) o.c. and cross bars at 4 inches (100 mm) o.c., NAAMM designation: W-15-4 (1-1/4 x 3/16) STEEL.
 2. Surface: Plain.
 3. Finish: Shop prime paint.

- G. Fabricate grating treads with steel plate nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
- H. Fabricate grating treads with cast abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
- I. Fabricate grating platforms with nosing matching that on grating treads at all landings. Provide toe plates at open-sided edges of grating platform. Secure grating to platform frame with welds.

2.12 STEEL PIPE HANDRAILS AND RAILING SYSTEMS

- A. General: Fabricate pipe handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that required to support structural loads.
- B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
 - 1. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, and weld all around.
- C. Form changes in direction of handrails and rails as follows:
 - 1. As detailed.
 - 2. By welding in prefabricated flush elbow fittings.
 - 3. By radius bends of radius indicated.
 - 4. By flush radius bends.
 - 5. By bending.
 - 6. By any method indicated above, applicable to change of direction involved.
- D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- F. Close exposed ends of pipe by welding 3/16-inch- (4.8-mm-) thick steel plate in place or with prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch (6 mm) or less.
- G. Fabricate newels of steel tubing and provide newel caps of gray-iron castings, as shown.
- H. Fabricate newels of steel tubing and provide newel caps of pressed steel, as shown.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of handrails and railing systems to other work. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work.
 - 1. Connect railing posts to stair framing by direct welding, unless otherwise indicated.
- J. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to

structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

- K. For galvanized handrails and railing systems, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- L. For nongalvanized steel handrails and railing systems, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

2.13 STAIR HANDRAILS AND RAILING SYSTEMS

- A. General: Comply with applicable requirements of Division 5 Section "Pipe and Tube Railings" for steel pipe railings and handrails, and as follows:
 - 1. Fabricate newels of steel tubing and provide newel caps of gray-iron castings, as shown.
 - 2. Railings may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
 - 3. Connect railing posts to stair framing by direct welding, unless otherwise indicated.

2.14 FINISHES

- A. General: Finish metal stairs after assembly.
 - 1. Comply with NAAMM "Metal Finishes Manual" for recommendations on application and designations of finishes.
- B. Galvanizing: Hot-dip galvanize items indicated to be galvanized to comply with applicable standard listed below:
 - 1. ASTM A 153 for galvanizing iron and steel hardware.
 - 2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick and heavier.
 - 3. Fill vent and drain holes that will be exposed in the finished work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed units:
 - 1. Exteriors (SSPC Zone 1B): SSPC SP 6 "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC SP 3 "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces, except those with galvanized finish or those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, weld plates, and anchor bolts. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

- A. **Fastening to In-Place Construction:** Provide anchorage devices and fasteners where necessary for securing steel stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors as required.
- B. **Cutting, Fitting, and Placement:** Perform cutting, drilling, and fitting required for installing steel stairs. Set units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Install steel stairs by welding stair framing to steel structure or to weld plates cast into concrete, except where otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted field connections.
- F. **Field Welding:** Comply with the following requirements:
 - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- G. **Corrosion Protection:** Coat concealed surfaces of aluminum that will come into contact with concrete or dissimilar metals with a heavy coat of bituminous paint.

- H. Install precast treads with adhesive supplied by manufacturer.

3.3 INSTALLING STEEL STAIRS WITH GROUTED BASE PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base plates.
- B. Set steel stair base plates on wedges or other adjustable devices. After the stairs have been positioned and aligned, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING STEEL PIPE RAILINGS AND HANDRAILS

- A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
1. Anchor posts to steel by welding directly to steel supporting members.
 2. Anchor handrail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into wall construction with drilled-in expansion anchors.
- B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
 3. For concrete and solid masonry anchorage, use drilled-in expansion anchor.
 4. For hollow masonry anchorage, use toggle bolts having square heads.
 5. For wood stud partitions, use lag bolts set into wood backing between studs. Coordinate with stud installations for accurate location of backing members.
 6. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on steel stairs are specified in Division 9 Section "Painting."
- C. For galvanized surfaces, clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05510

SECTION 05521 - PIPE AND TUBE RAILINGS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe and tube handrails and railing systems.
- B. Related Sections: Requirements relating to this Section are contained in the following Sections:
 - 1. Division 5 Section "Metal Stairs" for steel pipe handrails and railing systems included with metal stairs.

1.3 DEFINITIONS

- A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
 - 1. Cold-Formed Structural Steel: AISI "Specification for the Design of Cold-Formed Steel Structural Members."
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on the following:
 - 1. Testing performed according to ASTM E 894 and E 935.
 - 2. Structural computations.
- C. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
 - 1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.

- b. Uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot (730 N/m) applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.
 - a. Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress on guard.
 - D. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing handrails and railing systems to prevent buckling, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
 1. Temperature Change (Range): 120 deg F (67 deg C) ambient 180 deg F (100 deg C) material surfaces.
 - E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- 1.5 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 mechanically connected handrails and railing systems, each kind of fitting, grout, anchoring cement, and paint products.
 - C. Shop drawings showing fabrication and installation of handrails and railing systems including plans, elevations, sections, details of components, and attachments to other units of Work.
 1. For installed handrails and railing systems indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.
 - D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project names, addresses, names of architects and owners, and other information specified.
 - E. Product test reports from a qualified independent testing agency evidencing compliance of handrails and railing systems with requirements based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.
- B. Engineer Qualifications: Professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated for handrails and railing systems similar to this Project in material, design, and extent, and that have a record of successful in-service performance.

1.7 STORAGE

- A. Store handrails and railing systems inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where handrails and railing systems are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating handrails and railing systems without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.9 SEQUENCING AND SCHEDULING

- A. Sequence and coordinate installation of wall handrails as follows:
 - 1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
 - 2. Mount handrails on plaster or gypsum board assemblies only where reinforced to receive anchors and where the location of concealed reinforcements has been clearly marked for benefit of Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering handrails and railing systems that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Steel Pipe and Tube Railings:
 - a. Humane Equipment Co.

- b. Wagner: R & B Wagner, Inc.

2.2 METALS

- A. General: Provide metals free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Stainless Steel: Grade and type designated below for each form required:
 - 1. Tubing: ASTM A 554, grade as follows:
 - a. Grade MT 304.
 - 2. Pipe: ASTM A 312 (ASTM A 312M), grade as follows:
 - a. Grade TP 304.
 - 3. Castings: ASTM A 743 (ASTM A 743M), Grade CF 8 or CF 20.
 - 4.. Plate: ASTM A 167, type as follows:
 - a. Type 304.
- C. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:
 - 1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
 - a. Galvanized finish for exterior installations and where indicated.
 - b. Type F, or Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.
 - 2. Steel Tubing: Product type (manufacturing method) and other requirements as follows:
 - a. Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:
 - 1) Grade A, unless otherwise indicated or required by structural loads.
 - b. Hot-Formed Steel Tubing: ASTM A 501.
 - c. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).
 - 4. Gray Iron Castings: ASTM A 48, Class 30.
 - 5. Malleable Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).
- D. Brackets, Flanges, and Anchors: Cast or formed metal of the same material and finish as supported rails, unless otherwise indicated.

2.3 WELDING MATERIALS, FASTENERS, AND ANCHORS

- A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railings to other types of construction indicated and capable of withstanding design loadings.
1. For steel railings and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 2. For aluminum railings, provide fasteners fabricated from type 304 or type 316 stainless steel.
 3. For stainless steel railings, provide fasteners fabricated from type 304 or type 316 stainless steel.
- C. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
1. Provide concealed fasteners for interconnecting railing components and their attachment to other work, except where otherwise indicated.
 2. Provide concealed fasteners for interconnecting railing components and their attachment to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.
 3. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials, capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified, independent testing agency.
1. Cast-in-place anchors.
 2. Expansion anchors.

2.4 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure, complying with performance requirements of FS TT-P-664.
- B. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and compatibility with finish paint systems indicated, complying with SSPC-Paint 5.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint 20.

2.5 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

- B. Interior Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.
- C. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.
- D. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Nonshrink, Nonmetallic Grouts:
 - a. B-6 Construction Grout; W.R. Bonsal Co.
 - b. Diamond-Crete Grout; Concrete Service Materials Co.
 - c. Supreme; Cormix Construction Chemicals.
 - d. Sure-grip High Performance Grout; Dayton Superior Corp.
 - e. Euco N-S Grout; Euclid Chemical Co.
 - f. Five Star Grout; Five Star Products.
 - g. Vibropruf #11; Lambert Corp.
 - h. Crystex; L & M Construction Chemicals, Inc.
 - i. Masterflow 928 and 713; Master Builders Technologies, Inc.
 - j. Sealtight 588 Grout; W.R. Meadows, Inc.
 - k. SonogROUT 14; Sonneborn Building Products--ChemRex, Inc.
 - l. Kemset; The Spray-Cure Company.
 - 2. Interior Anchoring Cement:
 - a. Ankertite Cement; Dayton Superior Corp.
 - b. Por-Rok; Minwax Construction Products Division.
 - 3. Erosion-Resistant Anchoring Cement:
 - a. Bonsal Anchor Cement; W.R. Bonsal Co.
 - b. Super Por-Rok; Minwax Construction Products Division.
 - c. Thorogrip; Thoro Systems Products.

2.6 FABRICATION

- A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads.
- B. Assemble handrails and railing systems in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- C. Form changes in direction of members as follows:
 - 1. By radius bends of radius indicated.
 - 2. By flush radius bends.

3. By insertion of prefabricated flush elbow fittings.
 4. By any method indicated above, applicable to change of direction involved.
- D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Welded Connections: Fabricate handrails and railing systems for connection of members by welding. For connections made during fabrication, weld corners and seams continuously to comply 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. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe or tube to which end is joined, and weld all around.
 5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- F. Nonwelded Connections: Fabricate handrails and railing systems by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
1. Fabricate splice joints for field connection using epoxy structural adhesive where this represents manufacturer's standard splicing method.
- G. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing system members to other construction.
- H. Provide inserts and other anchorage devices to connect handrails and railing systems to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.
- I. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- J. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.
- K. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- L. Provide weepholes, or another means to evacuate entrapped water, in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.
- M. Fabricate joints that will be exposed to weather in a manner to exclude water.
- N. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.
- 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 they are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railing systems.

2.8 STAINLESS STEEL FINISHES

- A. Remove or blend tool and die marks and stretch lines into finish.
- B. Grind and polish surfaces to produce uniform directional textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. 180-Grit Polished Finish: Oil-ground, uniform, textured finish.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.9 STEEL FINISHES

- A. Galvanized Finish: Hot-dip galvanize items indicated to be galvanized to comply with applicable standard listed below:
 - 1. ASTM A 153 for galvanizing iron and steel hardware.
 - 2. ASTM A 123 for galvanizing iron and steel products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized handrails and railing systems, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel handrails and railing systems, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except provide galvanized anchors where embedded in exterior masonry and concrete construction.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- F. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed railings:
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 7 "Brush-Off Blast Cleaning."
- G. Apply shop primer to prepared surfaces of handrails and railing components, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Do not apply primer to galvanized surfaces.
 2. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railing systems. Set handrails and railing systems accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/4 inch in 12 feet (2 mm in 1 m).
 3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (2 mm in 1 m).
- C. Field Welding: Comply with the following requirements:
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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.
- D. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and railing systems and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Locate exposed fasteners in least conspicuous locations. Seal recessed holes of exposed locking screws with plastic filler, cement colored to match finish of handrails and railing systems.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact, or use fittings designed for this purpose.
- C. Expansion Joints: Install expansion joints at locations indicated but not further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING RAIL ENDS

- A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with postinstalled anchors and bolts.
- B. Anchor rail ends to metal surfaces with oval or round flanges.
 - 1. Weld flanges to rail ends.
 - 2. Connect flanges to rail ends using nonwelded connections.
 - 3. Bolt flanges to metal surfaces.

3.5 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and wall return fittings to building construction as follows:
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. For wood stud partitions, use lag bolts set into wood backing between studs. Coordinate with stud installation to accurately locate backing members.
 - 3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

3.6 ADJUSTING AND CLEANING

- A. Clean the following metals by washing thoroughly with clean water and soap, followed by rinsing with clean water.
 - 1. Aluminum.
 - 2. Stainless steel.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

- C. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

3.8 PROTECTION

- A. Protect finishes of handrails and railing systems from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05521

SECTION 06100 - ROUGH CARPENTRY**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Framing with dimension lumber.
 - 2. Wood furring, grounds, nailers, and blocking.
 - 3. Sheathing.

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

1.4 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 the following products:
 - 1. Engineered wood products.
 - 2. Underlayment.
 - 3. Insulating sheathing.
 - 4. Air-infiltration barriers.
 - 5. Metal framing anchors.
 - 6. Construction adhesives.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- B. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood product from one source and by a single manufacturer.
- C. Single-Source Responsibility for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product from one source and by a single producer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
 - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 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. Wood-Preservative-Treated Materials:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Hickson Corp.
 - e. Hoover Treated Wood Products, Inc.
 - f. Osiose Wood Preserving, Inc.
 - 2. Metal Framing Anchors:
 - a. Cleveland Steel Specialty Co.
 - b. Harlen Metal Products, Inc.
 - c. Silver Metal Products, Inc.
 - d. Simpson Strong-Tie Company, Inc.
 - e. Southeastern Metals Manufacturing Co., Inc.

2.2 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. NELMA - Northeastern Lumber Manufacturers Association.
 - 2. NLGA - National Lumber Grades Authority (Canadian).
 - 3. RIS - Redwood Inspection Service.
 - 4. SPIB - Southern Pine Inspection Bureau.
 - 5. WCLIB - West Coast Lumber Inspection Bureau.
 - 6. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
1. Provide dressed lumber, S4S, unless otherwise indicated.
 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.
 3. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
- B. Non-Load-Bearing Interior Partitions: Provide framing of the following grade and species:
1. Grade: Construction, Stud, or No. 3.
 2. Species: Eastern softwoods; NELMA.
 3. Species: Spruce-pine-fir south; NELMA.
 4. Species: Hem-fir north; NLGA.
 5. Species: Spruce-pine-fir north; NLGA.
 6. Species: Northern species; NLGA.
 7. Species: Southern pine; SPIB.
 8. Species: Mixed southern pine; SPIB.
 9. Species: Hem-fir; WCLIB or WWPA.
 10. Species: Spruce-pine-fir south; WCLIB or WWPA.
 11. Species: Western woods; WCLIB or WWPA.
 12. Species: Any species above.
- C. Exterior and Load-Bearing Walls: Provide framing of the following grade and species:
- D. Framing Other than Non-Load-Bearing Partitions: Provide framing of the following grade and species:
1. Grade: Construction, Stud, or No. 3.
 2. Species: Spruce-pine-fir south; NELMA.
 3. Species: Douglas fir-larch north; NLGA.
 4. Species: Hem-fir north; NLGA.
 5. Species: Spruce-pine-fir north; NLGA.
 6. Species: Southern pine; SPIB.
 7. Species: Mixed southern pine; SPIB.
 8. Species: Douglas fir-larch; WCLIB or WWPA.
 9. Species: Hem-fir; WCLIB or WWPA.
 10. Species: Douglas fir south; WWPA.
 11. Species: Any species above.
- E. Other Framing Not Listed Above: Provide the following grades and species:
1. Grade: Construction, Stud, or No. 3.
 2. Species: Douglas fir-larch north; NLGA.

3. Species: Hem-fir north; NLGA.
4. Species: Southern pine; SPIB.
5. Species: Douglas fir-larch; WCLIB or WWPA.
6. Species: Hem-fir; WCLIB or WWPA.
7. Species: Douglas fir south; WWPA.
8. Species: Any species above.

F. Exposed Framing: Provide material hand-selected from lumber of species and grade indicated below for uniformity of appearance and freedom from characteristics that would impair finish appearance.

1. Species and Grade: As indicated above for load-bearing construction of same type.

2.4 BOARDS

A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:

1. Moisture Content: 19 percent maximum.
2. Species and Grade: Eastern white pine, D Select per NELMA or NLGA rules.

B. Concealed Boards: Where boards will be concealed by other work, provide lumber with 19 percent maximum moisture content and of following species and grade:

1. Species and Grade: Eastern softwoods, No. 3 Common per NELMA rules.
2. Species and Grade: Northern species, No. 3 Common or Standard per NLGA rules.
3. Species and Grade: Mixed southern pine, No. 2 per SPIB rules.
4. Species and Grade: Hem-fir, Standard per WCLIB rules or No. 3 Common per WWPA rules.
5. Species and Grade: Spruce-pine-fir, Standard per WCLIB rules or No. 3 Common per WWPA rules.
6. Species and Grade: Western woods, Standard per WCLIB rules or No. 3 Common per WWPA rules.
7. Species and Grade: Any species above.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.7 METAL FRAMING ANCHORS

- A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:
 - 1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.
 - 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.
- C. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: 0.052 inch (1.3 mm).
- D. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 - 1. Strap Width: 1-1/2 inches (38 mm).
 - 2. Thickness: 0.052 inch (1.3 mm).
- E. Bridging: Rigid, V-section, nailless type, 0.064 inch (1.6 mm) thick, length to suit joist size and spacing.
- F. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch (50-mm) minimum side cover, socket 0.064 inch (1.6 mm) thick, standoff and adjustment plates 0.108 inch (2.8 mm) thick.

- G. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - 1. Width: 1-1/4 inches (32 mm).
 - 2. Thickness: 0.052 inch (1.3 mm).
 - 3. Length: As indicated.
- H. Rafter Tie-Downs (Hurricane Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-5/8 inches (41 mm) wide by 0.052 inch (1.3 mm) thick.
- I. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches (32 mm) wide by 0.052 inch (1.3 mm) thick by 36 inches (900 mm) long.
- J. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of 2 bolts placed 7 bolt diameters from reinforced base.
- K. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch (24 by 24 by 1 mm) thick with hemmed edges.

2.8 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Published requirements of metal framing anchor manufacturer.

- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- G. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
- H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING

- A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
 - 1. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.
- B. Furring to Receive Plywood Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring at 24 inches (610 mm) o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring at 16 inches (406 mm) o.c., vertically.
- D. Furring to Receive Plaster Lath: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring at 16 inches (406 mm) o.c., vertically.

3.4 WOOD FRAMING, GENERAL

- A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Install framing members of size and at spacing indicated.
- D. Do not splice structural members between supports.

- E. Firestop concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where firestopping is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal- (38-mm actual-) thickness lumber of same width as framing members.

3.5 WALL AND PARTITION FRAMING

- A. General: Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction, unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) size wood studs spaced 24 inches (610 mm) o.c., except where otherwise indicated or required.
 - 2. For interior partitions and walls, provide 2-by-4-inch nominal- (38-by-89-mm actual-) size wood studs spaced 16 inches (406 mm) o.c., except where otherwise indicated or required.
- B. Construct corners and intersections with 3 or more studs. Provide miscellaneous blocking and framing as shown and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide continuous horizontal blocking at midheight of single-story partitions over 96 inches (2438 mm) high and multistory partitions, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs with headers not less than 4-inch nominal (89-mm actual) depth for openings 36 inches (900 mm) and less in width, and not less than 6-inch nominal (140-mm actual) depth for wider openings.
 - 2. For load-bearing walls, provide double-jamb studs for openings 72 inches (1800 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth shown or, if not shown, as recommended by AFPA's "Manual for Wood Frame Construction."
- D. Provide bracing in exterior walls, at both walls of each external corner, full-story height, unless otherwise indicated. Provide one of the following:
- E. Provide bracing in walls, at locations indicated, full-story height, unless otherwise indicated. Provide one of the following:
 - 1. Diagonal bracing at 45-degree angle using let-in 1-by-4-inch nominal- (19-by-89-mm actual-) size boards.
 - 2. Diagonal bracing at 45-degree angle using metal bracing.
 - 3. Plywood panels, not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.
 - 4. Performance-rated structural-use panels, not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.
 - 5. Particleboard sheathing panels, not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.
 - 6. In lieu of bracing at corners or at locations indicated, continuous gypsum sheathing may be provided in panels not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.

7. In lieu of bracing at corners or at locations indicated, continuous fiberboard sheathing, intermediate type, may be provided in panels not less than 48 by 96 inches (1219 by 2438 mm) applied vertically.

END OF SECTION 06100

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Interior standing and running trim.
- 2. Laminate-clad cabinets (plastic-covered casework).
- 3. Plastic-laminate countertops.
- 4. Stone countertops.

- B. Locations:

- 1. Break Room – car wash building
- 2. Administration offices – first floor operations building.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

- 1. Division 6 Section "Rough Carpentry" for exposed framing and for furring, blocking, shims, and hanging strips for installing interior woodwork.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

- B. Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stairwork are specified in Division 6 Section "Rough Carpentry."

1.4 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 product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

- C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- 1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.
 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
 4. Show veneer leaves with dimensions, grain direction, exposed face, and an identification number indicated for each leaf. Identification number shall indicate the flitch and the sequence within the flitch for each leaf.
 5. Apply WIC Certified Compliance Label to first page of shop drawings.
- D. Samples for initial selection of the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
1. Shop-applied transparent finishes.
 2. Shop-applied opaque finishes.
 3. Plastic laminates.
 4. Thermoset decorative overlays.
 5. Solid surfacing materials.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.
- B. Installer Qualifications: Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.
- C. Single-Source Responsibility: Arrange for production of interior architectural woodwork with sequence-matched wood veneers by a single firm.
1. Include the veneering of wood doors in the single-firm production where veneer matching extends across wood doors.
- D. Quality Standard: Except as otherwise indicated, comply with the following standard:
1. WIC Quality Standard: "Manual of Millwork" of the Woodwork Institute of California for grades of interior architectural woodwork, construction, finishes, and other requirements.
 - a. Provide WIC Certified Compliance Certificate indicating that woodwork meets requirements of grades specified.
 - b. Provide WIC Certified Compliance Certificate for Installation.
 - c. Mark one unit of each elevation of casework and plastic-laminate countertop with WIC Certified Compliance Label indicating quality grade required.
 2. The Contract Documents contain selections chosen from options in the Quality Standard as well as additional requirements beyond those of the Quality Standard. Comply with such selections and requirements in addition to the Quality Standard.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

- B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
 - 2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved schedule for cabinet hardware specified in Division 8 Section "Door Hardware" to fabricator of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated.
- B. Colors: As per Owner's selection.
- C. General: Provide materials that comply with requirements of the WIC quality standard for each type of woodwork and quality grade indicated, unless otherwise indicated.
 - 1. Hardboard: AHA A135.4.
 - 2. Medium-Density Fiberboard: ANSI A208.2.
 - 3. Particleboard: ANSI A208.1, Grade M-2.

4. Softwood Plywood: PS 1.
 5. Hardwood Plywood and Face Veneers: HPVA HP-1.
- D. Formaldehyde Emission Level for Medium-Density Fiberboard: Comply with requirements of NPA 9.
- E. Fiberboard: Medium-density fiberboard made without formaldehyde and complying with ANSI A208.2.
1. Product: Subject to compliance with requirements, provide Medite II by Medite Corp.
- F. Particleboard: ANSI A208.1, Grade M-2 made with phenol-formaldehyde resins.
- G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated in the Work include, but are not limited to, the following:
 - a. Formica Corporation.
 - b. Laminart.
 - c. Nevamar Corp.
 - d. Pioneer Plastics Corp.
 - e. Westinghouse Electric Corp.; Specialty Products Div.
 - f. Ralph Wilson Plastics Co.
- H. Adhesive for Bonding Plastic Laminate: Contact cement.

2.2 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware."
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.
- C. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA code number indicated.
1. Satin Stainless Steel, Stainless-Steel Base: BHMA 630.
- D. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.

2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.
- C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:
 1. Grade: Custom.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 1. Corners of cabinets and edges of solid-wood (lumber) members 3/4 inch (19 mm) thick or less: 1/16 inch (1.5 mm).
 2. Edges of rails and similar members more than 3/4 inch (19 mm) thick: 1/8 inch (3 mm).
 3. Corners of cabinets and edges of solid-wood (lumber) members and rails: 1/16 inch (1.5 mm).
- C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 1. Trial fit assemblies at the fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on approved shop drawings before disassembling for shipment.
- D. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Quality Standard: Comply with WIC Section 10, "Interior Trim."
 1. Grade: Custom.
- B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

- C. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- D. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.
- E. Wood Species: Any closed-grain hardwood listed in referenced woodworking standard.

2.6 LAMINATE-CLAD CABINETS (PLASTIC-COVERED CASEWORK)

- A. Quality Standard: Comply with WIC Section 15, "Plastic-Covered Casework."
 - 1. Grade: Custom.
- B. WIC Construction Style: Style A Frameless.
- C. WIC Construction Type: Type I multiple self-supporting units rigidly joined together.
- D. WIC Door and Drawer Front Style: Reveal overlay.
 - 1. Reveal Dimension: 1/2 inch (13 mm).
- E. WIC Door and Drawer Front Style: Lipped.
- F. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other than Tops: GP-50, 0.050-inch (1.270-mm) nominal thickness.
 - 2. Postformed Surfaces: PF-42, 0.042-inch (1.067-mm) nominal thickness.
 - 3. Vertical Surfaces: GP-50, 0.050-inch (1.270-mm) nominal thickness.
 - 4. Edges: GP-50, 0.050-inch (1.270-mm) nominal thickness.
- G. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other than Drawer Bodies: High-pressure decorative laminate, Grade GP-28.
 - 2. Drawer Sides and Backs: Solid hardwood lumber, shop finished.
 - 3. Drawer Bottoms: Hardwood plywood, shop finished.
- H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. Provide Architect's selections from laminate manufacturer's full range of colors and finishes in the following categories:
 - a. Solid colors.
- I. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2.7 COUNTERTOPS

- A. Quality Standard: Comply with applicable WIC section indicated below:
 - 1. WIC Section 16, "Laminated Plastic Countertops, Splashes and Wall Paneling."

2. Grade: Custom.
- B. Type of Top: High-pressure decorative laminate complying with the following:
1. Grade: GP-50, 0.050-inch (1.270-mm) nominal thickness.
 2. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - a. Provide Architect's selections from manufacturer's full range of colors and finishes in the following categories:
 - 1) Solid colors.
 3. Edge Treatment: Same as laminate cladding on horizontal surfaces.
 4. Core Material: Medium-density particleboard.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with WIC Section 26 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm)
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where necessary. Stagger joints in adjacent and related members. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
 1. Install standing and running trim with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.
- F. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide

unencumbered operation. Complete the installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 2. Maintain veneer sequence matching of cabinets with transparent finish.
- G. Tops: Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.
1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c.
- H. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 06402

SECTION 06600 - PVC WALL PANELING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Exterior-grade PVC wall panels.

1.3 RELATED SECTIONS

- A. Section 07920 (07 92 00) - Joint Sealants.

1.4 REFERENCES

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.5 SUBMITTALS

- A. Comply with Section 01330 (01 33 00) - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including the following:
 - 1. Panel and trim details.
 - 2. Installation instructions.
- C. Samples:
 - 1. Submit manufacturer's samples of wall panels, including tongue-and-groove edges and nailing fins.
 - 2. Submit manufacturer's samples of each type of trim to be installed.
- D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- E. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.
- F. Warranty: Submit manufacturer's standard warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

- B. Storage:
 - 1. Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
 - 2. Store wall panels flat.
- C. Handling: Protect materials during handling and installation to prevent damage.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Installing Wall Panels:
 - 1. Cold Temperatures: When installing wall panels in temperatures below 40 degrees F, Warm to a minimum of 60 degrees F overnight and leave space between panels to allow for expansion in accordance with manufacturer's instructions.
 - 2. Warm Temperatures: When installing wall panels in temperatures above 70 degrees F, warm panels to a minimum of 60 degrees F in accordance with manufacturer's instructions.
- B. Cutting Wall Panels:
 - 1. Cold Temperatures: Before field-cutting wall panels in temperatures below 40 degrees F, warm panels to a minimum of 60 degrees F overnight.

1.8 WARRANTY

- A. Warranty Period for Wall Panels: 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Extrutech Plastics, Inc.,
5902 West Custer Street,
Manitowoc, Wisconsin 54220
Toll Free (888) 818-0118
Phone (920) 684-9650
Fax (920) 684-4344.
Website: www.epiplastics.com
E-mail: info@epiplastics.com

2.2 PVC WALL PANELS

- A. Wall Panels: "P2400".
 - 1. Description: Tongue-and-groove, rib-reinforced wall panels with nailing fins.
 - 2. Material: 100 percent virgin, exterior-grade PVC.
 - 3. Outside Surface: Flat.
 - 4. Width: 24 inches.
 - 5. Thickness: 1/2 inch.
 - 6. Weight: 0.69 pound per square foot.

7. Surface Burning Characteristics, ASTM E 84:

- a. Flame Spread Index: 15.
- b. Smoke Developed Index: 350.

8. Color: White, glossy finish.

9. Nonporous

10. Waterproof

11. Corrosion proof

12. Acceptance: USDA

B. Trim

1. Material: 100 percent virgin, exterior-grade PVC.
2. Weight: 0.06 pound per linear foot. Color: Same as wall panels.

2.3 ACCESSORIES

A. Construction Adhesive: PL400 or Liquid Nails, as recommended by wall panel manufacturer.

B. Fasteners:

1. Fastening into Wood: Stainless steel, 1-1/4-inch, No. 8 truss-head sheet metal screws.
2. Fastening into Masonry: Stainless steel, Buildex Tapcon 3/16-inch by 1-1/4-inch screws, with 1/4-inch stainless steel washers.
3. Fastening into Metal: Stainless steel, 3/4-inch, No. 8 truss-head sheet metal or flat-head Tek screws.
4. Staples: Do not use.

C. Joint Sealants: As specified in Section 07901

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive wall panels.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin preparation or installation until unacceptable conditions are corrected.

3.2 PREPARATION

- A. Notify Architect of conditions that would adversely affect installation or subsequent use.
- B. Ensure wall panels are dry and clean.

3.3 INSTALLATION

- A. Install wall panels in accordance with manufacturer's instructions at locations indicated on the Drawings.

- B. Install wall panels plumb, level, square, flat, and in proper alignment.
- C. Install trim in accordance with manufacturer's instructions.
- D. Anchor wall panels with construction adhesive and fasteners in accordance with manufacturer's instructions.
- E. Fasteners:
 - 1. Install fasteners 16 inches to 24 inches on center into nailing fins.
 - 2. Keep top of screw head 1/16 inch above top of nailing fins, allowing panels to move slightly.
 - 3. Do not recess screw heads into nailing fins.
 - 4. Ensure nailing fins lay flat against surface, not deformed around screw heads.
 - 5. Ensure fasteners are not exposed.
- F. Cutting Wall Panels:
 - 1. Field-cut panels as necessary in accordance with manufacturer's instructions. 2. Ensure cuts are straight, square, and do not damage panels.
- G. Apply joint sealants as specified in Section 07901

3.4 ADJUSTING

- A. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Remove and replace damaged wall panels in accordance with manufacturer's instructions.
- C. Apply joint sealants as specified in Section 0701

3.5 CLEANING

- A. Clean wall panels promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.6 PROTECTION

- A. Protect installed wall panels from damage during construction.

END OF SECTION 06600

SECTION 07210 - BUILDING INSULATION**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Concealed building insulation.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Thermoplastic Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.
 - 2. Division 9 Section "Gypsum Board Assemblies" for insulation installed as part of metal-framed wall and partition assemblies.

1.3 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 insulation product specified.
- C. Product test reports from and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.
- D. Research or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence compliance of foam-plastic insulations with building code in effect for Project.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

1. Glass-Fiber Insulation:
 - a. CertainTeed Corporation.
 - b. Knauf Fiber Glass GmbH.
 - c. Owens-Corning Fiberglas Corporation.
 - d. Schuller International, Inc.
2. Slag-Wool-/Rock-Wool-Fiber Insulation:
 - a. Fibrex Inc.
 - b. Partek Insulations, Inc.
 - c. USG Interiors, Inc.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Unfaced Mineral-Fiber Blanket Insulation: Thermal insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type I (blankets without membrane facing).

1. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

C. Faced Mineral-Fiber Blanket Insulation: Thermal insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type III, Class A (blankets with reflective vapor-retarder membrane facing and flame spread of 25 or less); with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.

1. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
2. Flanged Units: Provide blankets fabricated with facing incorporating 5-inch- (127-mm-) wide flanges along edges for attachment to framing members.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
 - 1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. For wood-framed construction with faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to produce airtight installation after concealing finish material is in place.

3.5 PROTECTION

- A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07411 - INTERLOCKING TILE ZINC ROOFING**PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. All the Contract Documents, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. The Work of this Section shall include, but not be limited to, the following:
 - 1. Custom fabricated, mechanically attached, [prePATINA] zinc alloy interlocking tile roof panels as indicated on the Drawings, with all required accessories for a weatherproof installation.
 - 2. Zinc gutters and downspouts as indicated on the Drawings.
- B. Related Sections:
 - 1. Section 06100 – Rough Carpentry
 - 2. Section 07210 – Building Insulation
 - 3. Section 07410 – Metal Wall Panel Systems
 - 4. Section 07500 – Membrane Roofing
 - 5. Section 07620 – Sheet Metal Flashing and Trim
 - 6. Section 07720 – Roof Accessories
 - 7. Section 07920 – Joint Sealants

1.3 REFERENCES

- A. ASTM B69-11 – Architectural Rolled Zinc - Types 1 and 2 – Standard Specification for rolled zinc.
- B. RHEINZINK Division 7 Binder; 5TH Edition
- C. SMACNA – Architectural Sheet Metal Manual; 6th Edition; Chapter 6 as a minimum standard or these specification and details where they exceed.
- D. Names of the applicable building codes or other authorities having jurisdiction:
- E. As all documents are intended to be complementary, in the event of contradiction in the references, the RHEINZINK Division 7 Binder; 5TH Edition reference will govern.

1.4 SUBMITTALS

- A. Product Data: provide zinc manufacturer's product data for zinc sheet material including any fabricator's product specifications, standard details, and installation instructions. Indicate installer's intent for roof tile fabrication by shop fabrication or pre-manufactured zinc tiles.
- B. Installer References: Installer shall submit list of (3) completed "natural metal" roof installations (zinc or copper) of similar scope and complexity.
- C. Material Samples: submit 3" x 5" color samples [bright rolled, prePATINA blue-grey, prePATINA graphite-grey] as color representative for each zinc material to be used.
- D. Shop Drawings: show layouts of tiles on all roof plans, location of all roof penetrations, details of tile terminations, edge conditions, joints, corners, tile profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory and field assembly work. Provide actual dimensions to the greatest extent possible.
 - 1. Details for forming sheet metal components, including dimensions.
 - 2. Details for joining and securing sheet metal components, including vertical and horizontal seam patterns, clip spacing, fastener requirements, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of expansion joints, including direction of expansion and contraction (where applicable).
 - 5. Details of roof penetrations.
 - 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets and counter flashings.
 - 7. Details of special conditions, integrating mechanical, electrical and plumbing conditions.
 - 8. Details of connections to adjoining work
 - 9. Details of the following accessory items, at a scale of not less than 1 ½ inches per 12 inches:
 - a. Flashing and Trim
 - b. Gutters including outlet locations and expansion joints
 - c. Downspouts
 - d. Roof Access Steps
 - e. Safety Line Attachments
- B. As required by Architect, provide Engineering Calculations: Upon confirmation of roof deck/sheathing physical properties from Contractor, roof system installer to provide wind load (positive and negative pressure) calculations that meet or exceed specified uplift requirements. Submittal to include proper flat-lock tile clip specification; clip spacing and fastener specification, to meet uplift requirements. Submit written certification showing calculations prepared and stamped by a Professional Structural Engineer licensed and

registered in the project state. Show how design load requirements and other performance criteria have been satisfied.

1.5 QUALITY ASSURANCE

- A. Fabricator/Installer Qualifications: the zinc material manufacturer shall train the fabricator and installer of the zinc roof system. Field installation crew foreman to be experienced in working with natural metals.
- B. Single-Source: Utilize zinc coil/sheet produced by one manufacturer. Provide roof tiles, flashing, and gutter profiles fabricated from material of a single zinc manufacturer. Provide secondary materials, which are acceptable to the zinc manufacturer and tile fabricator. Award installation of roof underlayment and zinc roofing tiles to a single firm for undivided responsibility.
- C. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the RHEINZINK Division 7 Binder; 5TH Edition and SMACNA Architectural Sheet Metal Manual, 6th Edition.
- D. Field Measurements: Prior to fabrication of roof tile and flashing, take field measurements of structure or substrates to ensure proper fit and alignment.
- E. Pre-Installation Conference: Two weeks prior to commencement of work, convene an installation conference to include the Architect, General Contractor and Zinc roof Installer in order to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
 - 1. Review methods and procedures for installation including, but not limited to: substrates, sub framing, drains, curbs, and penetrations.
 - 2. Review drawings, specifications and roof submittals
 - 3. Review construction schedule verifying availability of all materials, personnel and equipment needed to proceed and avoid delays
 - 4. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including cold temperatures and temporary roofing.
- F. Mock-Up: As determined by the Architect, Contractor to provide roof carpentry for mock-up ready for zinc roof tile installation. Incorporate materials and methods of fabrication and installation identical with project requirements. Install mock-up at roof area location directed by Architect. Retain accepted mock-up as quality standard for acceptance of completed metal roofing. As appropriate, mock-up may be incorporated as part of final metal roofing work.
 - 1. Provide mock-up of sufficient size and scope to show typical pattern of joints, panel width, panel length, edge construction, a sample of soldering (where required) and finish texture and color.
 - 2. Provide mock-up of gutter and eave assembly
 - 3. Extent of mock-ups is indicated on the Drawings
 - 4. Obtain Architect's written approval of mock-ups prior to proceeding.

- G. Soldering: In accordance with manufacturer's instructions.
- H. Corrosion Control: Contractor to avoid direct contact of incompatible materials including but not limited to copper, red rosin paper and masonry cleaning solutions.

1.6 PERFORMANCE REQUIREMENTS

- A. Design roof assembly to conform to the requirements of the Building Code.
- B. Install sheet metal roofing tiles and underlayment system capable of withstanding exposure to weather without failure or infiltration of water into the building interior.
- C. Wind Load: Design and engineer sheet metal roof assemblies, including size and spacing of attachment devices, meeting requirements of local building codes.
- D. Thermal Movement: Provide systems and connections, which allow for thermal movement resulting from ambient temperature range of -4 °F to 176 °F.
- E. Structural Performance: Provide metal panels, anchors and attachments, which resist loads, required by code and loads as indicated on the Drawings without permanent deflection or deformation. Information on Drawings referring to specific design of attachment, panel stiffening, and structural systems is intended for information only. System performance, based on project conditions and compliance with all applicable codes and loading requirements, shall be the responsibility of the panel fabricator and installer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Protect from all possible damage. All zinc sheet, coil, and shop fabricated tiles to be crated and transported according to zinc manufacturer's and fabricator's recommendations.
- B. Store and handle in strict compliance with zinc manufacturer's instructions and recommendations.
 - 1. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weather tight ventilated covering. Slope cover to shed moisture. Allow for free airflow around covered material to exchange outside air.
 - 2. Require all personnel to wear clean white cotton gloves when handling and installing zinc tiles and accessories when no strippable film is present.
 - 3. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
 - 4. Store all zinc tiles and flashings so that they will not accumulate water.
- C. Exercise care in unloading, storing, and erecting tiles to prevent bending, warping, or surface damage.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

- E. Contractor to deny other trades onto finished roof without permission of zinc installer. Installer to limit unnecessary walking on finished roof. Require all personnel to wear uncontaminated, clean, rubber- soled shoes when installing or walking on roof.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Available Zinc Manufacturer: Subject to compliance with requirements, Manufacturers offering metal roof or wall panel materials that may be incorporated in the work include:
- I. RHEINZINK America, Inc.
Woburn, MA 01801 ph: (781) 729.0812
- B. Zinc Alloy Sheet/Coils:
- I. Titanium Zinc Alloy whose base is electrolytic high grade with a 99.995 % Zn degree of purity and alloying additives of 0.08% - 1.0% copper and 0.07% - .12% titanium, .001% - .015% aluminum in accordance with ASTM B69-11 – Architectural Rolled Zinc - Type 1 and Type 2.
 - a. Graphite-Grey
 - b. Interlocking tiles require a minimum of 3:12 pitch. Interlocking tile roof systems up to 6 in 12 require both ProRoofing and Air-Z or Enkamat (7008 or 7010). Interlocking tiles over a 6 in 12 require Air-Z, Enkamat (7008 or 7010) or ProRoofing.
 2. Minimum Panel Thickness: [0.7 mm (24 ga.), 0.8 mm (22 ga.)]
 3. Minimum Flashing Thickness: 0.7 mm (24 ga.)
 4. Finish; COLORLINE, color as selected by Architect from Kynar standard colors.
- C. Panel Fabricator or System Manufacturer:
1. Local/ Regional Sheet Metal Fabrication Shop
 2. Select roof tile manufacturer that has the equipment and personnel capable of providing quality zinc roof tile profiles as indicated on the drawings.
 3. Installer's option to purchase prefabricated roof tiles as provided by an approved and experienced RHEINZINK system partner or fabricator.

2.2 PROFILES

- A. Fabricated Roof Tile:
- I. Shape: Diamond, Square, or Rectangular Tile
- B. Size: As indicated on drawings
- C. Seams: Interlocking Flat-lock design (two hems turned out, two hems turned under) (Minimum $\frac{3}{4}$ ' length of hems)

- D. Tile Layout: As indicated on drawings

2.3 ACCESSORIES

- A. Provide all components necessary for a complete, functional, weatherproof assembly including, but not limited to, trims, copings, fascias, sills, flashings, counter flashings, door frame trim, corner units, clips, wall caps, copings, sealants, closures and fillers. Metal materials shall match panels and be zinc compatible.
- B. Clips & Fasteners: Provide stainless steel concealed clips and stainless steel fasteners; supplied in accordance with manufacturer's recommendations and to meet the load requirements as specified by architect and confirmed by engineering calculations. Attachment clips shall permit expansion and contraction of the tile system throughout the specified temperature range. When permeable air barrier sheets are used and as required by the architect to resist water penetration at the fastener penetration, provide fasteners with watertight washer gaskets (such as self-adhered membrane).
- C. Roof Ventilation Mat (capillary break): As indicated on drawings (but not required on façade applications), provide manufacturer's approved nylon non-woven ventilation mat equal to Air-Z by RHEINZINK or Enkamat (7010 or 7008), by Colbond, Enka, NC.
- D. Self-adhered Waterproof Underlayment: non-permeable self-adhering, high-temperature composite, butyl rubber-based, polyethylene-backed membrane such as Vycor Ultra as or other high-temperature "unreinforced" rubberized-asphalt or butyl rubber composite sheet.
- E. Permeable Underlayment: Permeable breather type underlayment membrane: Roof shield as manufactured by Vaproshield or Proctor Group (note fastener gasket requirement).
- F. Synthetic Underlayment: Low-perm film used as a substitute for felt. Manufactured in large sheets to minimize seams. Provide RoofTopGuard II, TriFlex 30 or equal.
- G. Solder: Lead-tin solder containing 50% tin and 50% lead in accordance with ASTM B32 – 08 or lead-free solder. Flux: Felder ZD-Pro or equal.
- I. Sealants:
1. Seam Sealing Tape: pressure-sensitive 100 per cent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, non-toxic non-staining tape.
 2. Joint Sealant: DOW 795; or other documented pH neutral sealant
 3. Backer rod shall be extruded polyethylene foam as DOW ETHAFOAM SB or equal.

2.4 TILE & FLASHING FABRICATION

- A. General: Custom fabricate sheet metal roofing tiles to comply with details shown and recommendations in SMACNA - Architectural Sheet Metal Manual; 6th Edition and RHEINZINK

Division 7 Binder; 5TH Edition that apply to the design, dimensions (tile width and tile height), geometry, metal thickness, and other characteristics of installation indicated. Shops fabricate sheet metal roofing tiles and accessories to greatest extent possible.

1. Interlocking Roofing Tiles: Form interlocking roofing tiles from coil or sheet stock with the grain running in the same direction. Two hems are to be folded out with the remaining two hems folded under. Hems should be a minimum of 3/4" in length
 2. Provide backside coated zinc or other permanent separation materials on concealed metal surfaces where tiles would otherwise be in direct contact with substrate materials that are non-compatible or could result in corrosion or deterioration of either material or finishes.
- B. Fabricate sheet metal roofing tiles to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.
1. Form and fabricate sheets, seams, strips, cleats, edge treatments, integral flashing, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required to resist Water infiltration without excessive use of sealants (dry Joints) while also allowing any water infiltration behind the roof panels to weep out
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with non-acidic sealant (concealed within joints) if determined to be necessary for weather-tight detail (dry joints are often acceptable).
- D. Sealant Joints: Where movable, non-expansion-type joints are indicated or required to produce weather tight seams, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards. In general, panel joints are intended to be dry, sealant-free, to facilitate air movement and drying behind the interlocking roof tiles.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Contractor shall inspect all surfaces, areas and other contingent construction in or to which his work is to be installed and insure himself that they are in proper condition to receive the work to be performed under this Section.
- B. Verify that sheathing surfaces are sound, dry, properly secured and that provision has been made for flashings, anchorage, and all other interface items attaching to or penetrating through the Work of this Section.
- C. To the greatest extent possible, Contractor and installer shall inspect roof deck before roof underlayment is applied. Installer shall the Contractor of any deck, penetration, or other sub

state condition requiring corrective action. Failure to make such an inspection shall be construed as acceptance of the existing conditions and the responsibility to provide an acceptable installation.

3.2 PREPARATION

- A. Verify field dimensions before fabrication. Notify Architect of any discrepancies between field measurements and dimensions indicated in Construction Documents.
- B. Place [permeable, synthetic, waterproof] underlayment membrane and venting mat on substrate surfaces to receive metal panels; comply with manufacturer's instructions.
 - 1. Coordinate installation of underlayment with metal roofing, rain drainage work, flashing, trim and construction of parapets, walls, and other adjoining work to provide a weatherproof, secure and non-corrosive installation.
 - 2. For underlayment end-laps and side-laps, see underlayment manufacturer's instructions for proper attachment, seaming, and termination recommendations.
 - 3. Apply weather barrier underlayment parallel to the eave.
- C. For loose-laid mechanically attached sheets, consult the architect for strategies preventing moisture infiltration through fastener holes. Potential solutions include but not limited to: applying sealant or self-adhered gaskets to backside of clips.

3.3 FIELD FABRICATION

- A. Form panels and flashings in shop to greatest extent possible. Field modify only as necessary.
- B. Ensure material temperature has moderated above 48 degrees F. prior to field fabrication.
- C. Cut prefabricated zinc tiles, and flashing with smooth (non-serrated) blade shears and snips. Bend zinc so that there are properly sized radius bends. Inspect initial panel and flashing bends to ensure material cracking has not occurred. NO SHARP BENDS
- D. Form rounded cuts and notches as made by MASC notching tool and demonstrated during zinc manufacturer fabrication training. Rounded cuts & notches are also possible by cutting to a predrilled hole.

3.4 INSTALLATION

- A. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of sheet metal being fabricated and installed.
 - 1. Do not install in inclement weather.
 - 2. Do not install over a damp substrate.
 - 3. Do not install when inclement weather is threatening.
 - 4. If covering of zinc panels is required, provide free airflow around the zinc material to manufacturer's requirement to prevent white rust.
- B. Install work to be truly straight and square or conform to curvilinear geometry indicated on drawings.

1. Fabricate and install work with lines and corners of exposed units true and accurate.
 2. Form exposed faces free of buckles, excessive waves, and avoidable tool marks considering temper and reflectivity of metal.
 3. Shim and align panel units within installed tolerance of ¼ inch in 20' –0"
 4. All seams shall be of uniform appearance and dimensions, straight and level with minimum exposure of solder and sealant.
 5. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
 6. Form all seams to be weatherproof, leaving room for expansion and contraction with specified and required tolerances.
 7. Comply with RHEINZINK Division 7 Binder; 5TH Edition and SMACNA Architectural Sheet Metal Manual for flashings and sheet metal work.
- C. Conceal fasteners and expansion provision where possible in exposed work, and locate so as to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- D. To avoid material tearing, provide cuts with rounded notching tool or cut to pre-drilled hole.
- E. Provide work as indicated on approved shop drawings form and fabricate sheets, seams, strips, cleats, edge treatments, integral flashings, and other components of metal panels to profiles, patterns, and drainage arrangements shown and as required for water shedding construction. Ensure that all shop and field fabricated bends have an acceptable "rounded" or radius bend. NO SHARP BREAKS
- F. Separate non-compatible materials with a rubberized asphalt underlayment.
- G. Install work to meet specified performance requirements.

3.5 CLEANING AND PROTECTION

- A. Remove protective film (if any) from exposed surfaces of metal panels promptly upon installation (or prior if film covers any concealed seam areas) with care to avoid damage to finish and in accordance with manufacturer's recommendations.
- B. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering and as recommended by panel manufacturer and maintain in a clean condition during construction. Never apply cleaner directly to zinc surface.
- C. Ensure that cleaning by other trades working in proximity to zinc installation is in accordance with the recommendations of the zinc manufacturer.
- D. Damaged units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair.
- E. For more complete instructions, please refer to RHEINZINK cleaning recommendations.

3.6 RECYCLING

- A. Collect all zinc drop-offs (scrap) and return to local scrap metal recycling facility for current market cash return.

3.7 CLEAN-UP

- A. During the progress of the work, keep premises clear of debris resulting from this operation and remove surplus and waste materials from the site as soon as possible.
- B. Upon completion of the work, Contractor shall remove from the site all equipment and materials used on the work as well as any debris resulting from the operations.

END OF SECTION 07411

SECTION 07412 - METAL WALL PANELS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Metal wall panels with concealed fasteners.
- B. Related Sections include the following:
 - 1. Division 5 Section "Cold-Formed Metal Framing" for metal studs, bracing, anchorage, and framing accessories.
 - 2. Division 6 Section "Rough Carpentry" for wood framing.
 - 3. Division 7 Section "Sheet Metal Flashing and Trim" for metal flashing and trim not part of this Work.
 - 4. Division 7 Section "Joint Sealants" for field-applied sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide manufactured wall panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.
- B. Air Infiltration: Provide manufactured wall panel assemblies with permanent resistance to air leakage through assembly of not more than 0.09 cfm/sq. ft. (0.45 L/s/sq. m) of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 4.0 lbf/sq. ft. (192 Pa).
- C. Water Penetration: Provide manufactured wall panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward acting, wind-load design pressure of not less than 6.24 lb/sq. ft. (300 Pa) and not more than 12.0 lb/sq. ft. (575 Pa).
- D. Structural Performance: Provide manufactured wall panel assemblies capable of withstanding design wind loads indicated under in-service conditions with deflection no greater than the following, based on testing manufacturer's standard units according to ASTM E 330 by a qualified independent testing and inspecting agency.
 - 1. Maximum Deflection: 1/180 of the span.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.
- B. Shop Drawings: Show layouts of panels, details of corner conditions, joints, panel profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work.
 - 1. For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: Manufacturer's color charts or chips showing the full range of colors, textures, and patterns available for wall panels with factory-applied finishes.
- D. Samples for Verification: Provide sample panels 12 inches (300 mm) long by actual panel width, in the profile, style, color, and texture indicated. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
- E. 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.
- F. Product Test Reports: Indicate compliance of manufactured wall panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed metal wall panel projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to ASTM E 699.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation or handling.
- B. Handling: Exercise care in unloading, storing, and erecting wall panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish opening dimensions and proceed with fabricating wall panels without field measurements or allow for trimming panel units. Coordinate wall construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

1.8 WARRANTY

- A. Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal wall panels within the specified warranty period and agreeing to repair finish or replace wall panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
- B. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide panels by one of the following: Basis of Design: CENTRIA, Concept Series Metal Wall Panels. Provide basis of design product.
 - 1. Steel Wall Panels:
 - a. CENTRIA Architectural Systems; Moon Township, PA 15108-2944. 8000. Fax: (412) 299-8317. NTRIA.com. Web: www.CENTRIA.com.

2.2 METAL WALL PANEL MATERIALS

- A. Metallic-Coated Steel Face Sheet: Coil-coated, ASTM A 755/A 755M.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Class Z275), structural steel quality.
 - 2. Face Sheet: Minimum (0.024 inch/24 gage) (0.60 mm) nominal uncoated thickness.
 - 3. Surface: Smooth.

2.3 CONCEALED FASTENER METAL WALL PANELS

- A. Three-rib Profile MWP# :
 - 1. Basis of Design Product: CENTRIA, CS-260.
 - 2. Panel Coverage: (12 inches) (305 mm).

3. Panel Height: (0.875 inch) (22 mm).

2.4 METAL WALL PANEL ACCESSORIES

A. Metal Wall Panel Accessories, General

1. Provide complete metal wall panel assembly incorporating trim, copings, fasciae, parapet caps, soffits, sills, inside and outside corners, and miscellaneous flashings. Provide manufacturer's factory-formed clips, shims, flashings, gaskets, lap tapes, closure strips, and caps for a complete installation. Fabricate and install accessories in accordance with SMACNA 1793.

B. Formed Flashing and Trim

1. Match material, thickness, and color of metal wall panel face sheets.

C. Sealants

1. Type recommended by metal wall panel manufacturer for application, meeting requirements of Division 07 Section "Joint Sealants."

D. Flashing Tape

1. 4-inch wide self-adhering butyl flashing tape.

E. Fasteners, General

1. Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided for miscellaneous applications, supply corrosion-resistant fasteners with heads matching color of metal wall panels by means factory-applied coating.

F. Concealed Clips

1. Galvanized steel, (0.051 inch/16 ga.) (1.29 mm) thick, designed to allow of panel and configured to hold panel minimum (12.7 mm) from substrate.

2.5 METAL WALL PANEL FINISHES

A. Fluoropolymer Two-Coat System

1. 0.2-mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat, AAMA 620.
2. Basis of Design: CENTRIA Fluorofinish.

B. Color

1. Exterior Surface; Silversmith #9946

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements indicated for conditions affecting performance of metal panel walls.
 - 1. Panel Supports and Anchorage: Examine wall framing to verify that girts, angles, and other secondary structural panel support members and anchorage have been installed to meet requirements of panel manufacturer.
 - 2. Do not proceed with wall panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate metal wall panels with rain drainage work; flashing; trim; and construction of soffits, roofing, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.
- C. Secondary Structural Supports: Install girts, angles, and other secondary structural panel support members and anchorage according to the Light Gage Structural Institute's "Guide Specifications," Section 07410, "Manufactured Roof and Wall Panels."

3.3 PANEL INSTALLATION

- A. General: Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cutting exterior panels by torch is not permitted.
 - 2. Install panels with concealed fasteners.
 - 3. Install panels with exposed exterior and interior fasteners, prefinished to match panel finishes.
 - 4. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled, uniform compression for positive seal without rupture of neoprene washer.
- B. Accessories: Install components required for a complete wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips, and similar items.
- C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not otherwise indicated, types recommended by panel manufacturer.
 - 1. Install weatherseal to prevent air and moisture penetration. Flash and seal panels at ends and intersections with other materials with rubber, neoprene, or other closures to exclude weather.
 - 2. Seal panel end laps with a bead of tape or sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
 - 3. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

- D. Wall Panels: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as necessary for waterproofing. Handle and apply sealant and back-up according to sealant manufacturer's written instructions.
 - 1. Align bottom of wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - 3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- E. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.
- F. Coat back side of metal panels with bituminous coating where it will contact wood, ferrous metal, or cementitious construction.
- G. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.4 CLEANING AND PROTECTING

- A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

END OF SECTION 07412

SECTION 07420 – FLAT LOCK TILE - FAÇADE SYSTEM**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 DESCRIPTION OF WORK

- A. The Work of this Section shall include, but not be limited to, the following:
 - 1. Custom fabricated, mechanically attached, zinc alloy flat lock vertical wall panels as indicated on the Drawings, with all required accessories for a weatherproof installation.
 - 2. Zinc coping and wall trim as indicated on the drawings.
- B. Related Sections:
 - 1. Section 05400 – Cold Formed Metal Framing
 - 2. Section 06100 – Rough Carpentry
 - 3. Section 07210 – Building Insulation
 - 4. Section 07412 – Metal Wall Panels
 - 5. Section 07542 - Thermoplastic Polyolefin (TPO) Roofing
 - 6. Section 07620 – Sheet Metal Flashing and Trim
 - 7. Section 07720 – Roof Hatches (Bilco Type S)
 - 8. Section 07901 – Joint Sealants

1.03 REFERENCES

- A. ASTM B69-13 – Architectural Rolled Zinc - Types 1 and 2 – Standard Specification for rolled zinc. RHEINZINK Division 7 Binder; 5TH Edition
- B. SMACNA – Architectural Sheet Metal Manual; 7th Edition; Chapter 7 as a minimum standard or these specification and details where they exceed.
- C. As all documents are intended to be complementary, in the event of contradiction in the references, the RHEINZINK Division 7 Binder; 5TH Edition will govern.

1.04 SUBMITTALS

- A. Provide product data for [zinc wall panels] including manufacturer's product specifications, standard details, and installation instructions.

- B. Material Samples: submit PATINA graphite-grey samples of each material that is to be exposed in the finished work.
- C. Shop Drawings: show layouts of panels on all wall elevations, details of panel terminations, edge conditions, joints, corners, panel profiles, supports, anchorages, trim, flashings, closures, and special details. Provide actual dimensions to the greatest extent possible for all plan, and detail conditions.
 - 1. Details for shop fabricated sheet metal components, including seams and dimensions.
 - 2. Details for joining and securing sheet metal components, including layout, number of required fasteners, clips and other attachments. Include pattern of seams and spacing of fasteners and clips.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of expansion joints, including direction of expansion and contraction.
 - 5. Details of wall penetrations such as doors, windows, and louvers.
 - 6. Details of edge conditions, sills, parapets and counter flashings.
 - 7. Details of special conditions, integrating mechanical, electrical and plumbing conditions.
 - 8. Details of connections to adjoining work
- D. Engineering Calculations: Installer to provide positive and negative wind load pressure calculations and design performance certification of the wall panel system. Submit written certification showing calculations prepared and stamped by a Professional Structural Engineer licensed and registered in the project state. Show how design load requirements and other performance criteria have been satisfied.

1.05 QUALITY ASSURANCE

- A. Fabricator/Installer Qualifications: the zinc material manufacturer and system fabricator shall train the fabricator and installer of the wall panel system. Installer shall submit list of successful installations of projects (3 minimum) that have had similar complexity and scope.
- B. Source: Provide panels, which are the product of one manufacturer. Provide secondary materials, which are acceptable to the zinc manufacturer. Award installation of zinc wall panels, including underlayment and membrane to a single firm for undivided responsibility.
- C. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the RHEINZINK Division 7 Binder; 5TH Edition and SMACNA Architectural Sheet Metal Manual 6th Edition. Conform to dimensions and profiles shown.
- D. Field Measurements: Prior to fabrication of panel systems, verify drawing dimensions by taking field measurements of structure or substrates to receive panel systems.
- E. Soldering: In accordance with manufacturer's instructions.
- F. Corrosion Control: Avoid direct contact of incompatible materials including but not limited to copper, red rosin paper and masonry cleaning solutions.

1.06 PERFORMANCE REQUIREMENTS

- A. Install sheet metal wall panels and underlayment system capable of withstanding exposure to weather without failure or infiltration of water into the building interior
- B. Wind Load: Design and engineer sheet metal wall assemblies, including size and spacing of attachment devices, meeting requirements, engineering calculations and local building codes.
- C. Thermal Movement: Provide systems and detail connections, which allow for thermal movement resulting from ambient temperature range of -4 °F to 176 °F.
- D. Structural Performance: Provide metal panels, anchors and attachments, which resist loads, required by code and loads as indicated on the Drawings without permanent deflection or deformation. Information on Drawings referring to specific design of attachment, panel stiffening, and structural systems is intended for information only. System performance, based on project conditions and compliance with all applicable codes and loading requirements, shall be the responsibility of the panel fabricator and installer.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Protect from all possible damage. All zinc to be transported according to manufacturer's recommendations.
- B. Store and handle in strict compliance with manufacturer's instructions and recommendations.
 - 1. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weatherproof ventilated covering. Slope cover to shed moisture. Allow for free airflow around covered material to exchange outside air.
 - 2. Require all personnel to wear clean white cotton gloves when handling and installing zinc panels and accessories when no strippable film is present.
 - 3. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
 - 4. Store metal wall panels so that they will not accumulate water or excess moisture.
- C. Exercise care in unloading, storing, and erecting panels to prevent bending, warping, or surface damage.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.08 WARRANTY

- A. Material Only Warranty: provide X-year limited warranty for Titanium-Zinc alloy from original rolling mill manufacturer. Warranty to cover the material quality of the sheet/ coil material used to fabricate sheet metal flashing & trim profiles appropriate for zinc installation.

- B. Fabrication Warranty: provide X-year fabrication warranty against sharp bends that fracture the metal, tears, and equipment induced damage to the Architectural Zinc sheet or coil.
- C. Installation Warranty: provide X-year guarantee covering the proper material or product application preventing failure due to hot-water corrosion, damage due to inappropriate slip sheet, absorptive separation material, or other installer induced failure.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal wall panel materials that may be incorporated in the work include:
 - 1. RHEINZINK America, Inc.
Woburn, MA 01801 ph: (781) 729.0812
- B. Zinc Alloy Sheet/Coils:
 - 1. Titanium Zinc Alloy whose base is electrolytic high grade with a 99.995 % Zn degree of purity and alloying additives of 0.08% - 1.0% copper and 0.07% - .12% titanium, .001% - .015% aluminum in accordance with ASTM B69-13 – Architectural Rolled Zinc - Type 1 and Type 2.
 - 2. Minimum Panel Thickness: [0.7mm (24 ga.), 0.8 mm (22 ga.), 1.0 mm (20 ga.)]
 - 3. Minimum Flashing Thickness: 0.7 mm (24 ga.)
- C. Panel Fabricator or System Manufacturer:
 - 1. Local / Regional Sheet Metal Fabrication Shop.
 - a. Select wall panel fabricator that has the equipment and personnel capable of providing quality zinc wall panel profiles as indicated on the drawings.
 - b. Installer's option to purchase prefabricated wall panels as provided by an approved and experience RHEINZINK system partner or fabricator.

2.02 FRAMING

- A. Provide additional sub framing components, hats, zees, or similar light-gauge metal profile to provide air space as indicated on drawings. All framing members and components shall be fabricated from ASTM A525 G90 galvanized sheet steel. Provide all secondary framing members as required for panel installation whether indicated or not on the architectural drawings.

- B. Coordinate wall panel sub framing support with cold-formed metal framing, plywood sheathing, exterior gypsum sheathing, and furring, or galvanized steel strapping for complete structural support for performances indicated.

2.03 ACCESSORIES

- A. Provide all components necessary for a complete, functional, weatherproof assembly including, but not limited to, trims, copings, fascias, sills, flashings, counter flashings, door frame trim, corner units, clips, wall caps, copings, sealants, closures and fillers. Metal materials shall match panels and be zinc compatible.
- B. Clips & Fasteners: Provide stainless steel concealed clips and stainless steel fasteners; supplied in accordance with manufacturer's recommendations and to meet the load requirements as specified by architect and confirmed by engineering calculations. Attachment clips shall permit expansion and contraction of the panel system throughout the specified temperature range. When permeable air barrier sheets are used and as required by the architect to resist liquid water penetration at the fastener penetration, provide fasteners with watertight washer gaskets (such as self-adhered membrane).
- C. Solder: Lead-tin solder containing 50% tin and 50% lead in accordance with ASTM B32 – 08 or lead-free solder. Flux: Felder ZD-Pro or equal.
- D. Self-adhered Waterproof Underlayment: non-permeable self-adhering, high-temperature composite, butyl rubber-based, polyethylene-backed membrane such as Vycor Ultra as or other high-temperature rubberized-asphalt sheet.
- E. Permeable Underlayment: Permeable breather type underlayment membrane: Wallshield as manufactured by Vaproshield or A.Proctor Group (note fastener gasket requirement)
- F. Air Barrier Underlayment: Vapor permeable sheet underlayment: Tyvek Commercial Wrap or equal (note fastener gasket requirement).
- G. Sealants:
 - 1. Seam Sealing Tape: pressure-sensitive 100 per cent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, non-toxic non-staining tape. Note: Seam sealing tape is not required at typical flat lock tile joints or edge conditions. Refer to drawings for special conditions requiring sealant.
 - 2. Joint Sealant: DOW 795; or other documented pH neutral sealant.
 - 3. Backer rod shall be extruded polyethylene foam as DOW ETHAFOAM SB or equal.

2.04 PANEL FABRICATION

- A. General: Custom fabricate sheet metal wall panels to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" and RHEINZINK "Applications in Architecture" that apply to the design, dimensions (panel width and height), geometry, metal

thickness, and other characteristics of installation indicated. Shop fabricates sheet metal wall panels and accessories at the shop to greatest extent possible.

1. Flat-Lock Tile Wall Panels: Form flat-lock tile panels from continuous metal sheets, with two hooks (hems) turned under and two hooks (hems) turned over. A minimum of a $\frac{3}{4}$ " hook (hem) is required; relief cuts are recommended for ease of installation (contact RHEINZINK for proper notching pattern).
 2. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials that are non-compatible or could result in corrosion or deterioration of either material or finishes.
- B. Fabricate sheet metal wall panels to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.
1. Form and fabricate sheets, seams, strips, cleats, edge treatments, integral flashing, and other components of metal wall to profiles, patterns, and drainage arrangements shown and as required to resist Water infiltration without excessive use of sealants (dry joints) while also allowing any water infiltration behind the wall panels to weep out.
- C. Sealant Joints: Where movable, non-expansion type joints are indicated or required to produce weather tight seams such as at window and door penetrations, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Contractor shall inspect all surfaces, areas and other contingent construction in or to which his work is to be installed and insure himself that they are in proper condition to receive the work to be performed under this Section.
- B. Verify that sheathing surfaces are sound, dry, properly secured and that provision has been made for flashings, anchorage, and all other interface items attaching to or penetrating through the Work of this Section.
- C. The Contractor shall notify the Architect in writing, before any work is installed, of any condition requiring correction. Failure to make such a report shall be construed as acceptance of the existing conditions and the responsibility to provide an acceptable installation.

3.02 PREPARATION

- A. Verify field dimensions before fabrication. Notify Architect of any discrepancies between field measurements and dimensions indicated in Construction Documents.

- B. Place [air barrier, permeable underlayment, waterproof] membrane on substrate surfaces to receive metal panels; comply with manufacturer's instructions.
 - 1. Coordinate installation of underlayment (and strapping where applicable) with metal cladding, flashing, trim and coping to provide a weatherproof, secure and non-corrosive installation.
 - 2. For underlayment end and side laps, see underlayment manufacturer's instructions for proper attachment, seaming, and termination recommendations.

3.03 INSTALLATION

- A. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of sheet metal being fabricated and installed.
 - 1. Do not install in inclement weather
 - 2. Do not install over a damp substrate
 - 3. If covering of zinc panels is required, provide free airflow around the zinc material to manufacturer's requirement to prevent white rust.
- B. Install work to be truly straight and square or conform to curvilinear geometry indicated on drawings.
 - 1. Fabricate and install work with lines and corners of exposed units true and accurate.
 - 2. Form exposed faces free of buckles, excessive waves, and avoidable tool marks considering temper and reflectivity of metal.
 - 3. Shim and align panel units within installed tolerance of ¼ inch in 20' –0"
 - 4. All seams shall be of uniform appearance and dimensions, straight and level with minimum exposure of solder and sealant.
 - 5. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
 - 6. Form all seams to be weatherproof, leaving room for expansion and contraction with specified and required tolerances.
 - 7. Comply with RHEINZINK Division 7 Binder; 5TH Edition and SMACNA Architectural Sheet Metal Manual for flashings and sheet metal work.
- C. Conceal fasteners and expansion provision where possible in exposed work, and locate so as to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- D. Provide work as indicated on approved shop drawings
 - 1. Form and fabricate sheets, seams, strips, cleats, edge treatments, integral flashings, and other components of metal wall cladding to profiles, patterns, and drainage arrangements shown and as required for water shedding construction. Ensure that all shop & field fabricated bends have an acceptable "rounded" or radius bend. NO SHARP BREAKS.
- E. Separate non-compatible materials with a rubberized asphalt underlayment.

- F. Install work to meet specified performance requirements. Flat-Lock Tile panels are installed from the bottom up. CAUTION: Horizontal and Vertical Flat-Lock Tile panel applications become directional when notched according to RHEINZINK'S recommendations

3.04 CLEANING AND PROTECTION

- A. Remove protective film (if any) from zinc panel surfaces promptly upon installation (or prior if film covers any concealed seam areas) with care to avoid damage to finish.
- B. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering and as recommended by panel manufacturer and maintain in a clean condition during construction. Please reference RHEINZINK Cleaning Recommendations and Maintenance Instructions.
- C. Ensure that cleaning by other trades working in proximity to zinc installation is in accordance with the recommendations of the zinc manufacturer.
- D. Damaged units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair.

3.05 RECYCLING

- A. Collect all zinc drop-offs (scrap) and return to local scrap metal recycling facility for current market monetary return.

3.06 CLEAN-UP

- A. During the progress of the work, keep premises clear of debris resulting from this operation and remove surplus and waste materials from the site as soon as possible.
- B. Upon completion of the work, Contractor shall remove from the site all equipment and materials used on the work as well as any debris resulting from the operations.

END OF SECTION 07420

SECTION 07542 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein.

1.3 PERFORMANCE REQUIREMENTS

- A. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78.29 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- B. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- C. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For the following products:
 - 1. Sheet roofing, of color specified.
 - 2. 10 lb of aggregate ballast in gradation and color indicated.
 - 3. Roof paver, full sized, in each color and texture required.
- D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- E. Research/evaluation reports.
- F. Field quality-control reports.

- G. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product.
- B. Source Limitations: Obtain components including roof insulation fasteners <Insert products> for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- C. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- D. Preinstallation Roofing Conference: Conduct conference at Project site.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

- A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible fabric backed TPO sheet.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Custom Seal Roofing.
 - c. Firestone Building Products Company.
 - d. GAF Materials Corporation.
 - e. GenFlex Roofing Systems.
 - f. Johns Manville.
 - g. Mule-Hide Products Co., Inc.
 - h. Stevens Roofing Systems; Division of JPS Elastomerics.
 - i. Versico Incorporated.
 - 2. Thickness: 80 mils, nominal.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesive: 80 g/L.
 - f. Other Adhesives: 250 g/L.
 - g. Single-Ply Roof Membrane Sealants: 450 g/L.
 - h. Nonmembrane Roof Sealants: 300 g/L.
 - i. Sealant Primers for Nonporous Substrates: 250 g/L.
 - j. Sealant Primers for Porous Substrates: 775 g/L.
- B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- 2.3 SUBSTRATE BOARDS
- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick, unless shown otherwise.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
- 2.4 ROOF INSULATION
- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. minimum density, square edged.
- B. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. minimum density.

- C. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type IX, 1.8-lb/cu. ft. minimum density, with factory-applied facings, as follows:
 - 1. Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch thick.
- D. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
 - 1. Type V, OSB facer, 7/16 inch thick.
 - 2. Type VII, glass mat faced gypsum board facer, 1/4 inch thick.
- E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- B. Insulation Adhesive: Insulation manufacturer's recommended cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick, factory primed.

2.6 ASPHALT MATERIALS

- A. Roofing Asphalt: ASTM D 312, Type III or Type IV ASTM D 6152, SEBS modified.
- B. Asphalt Primer: ASTM D 41.

2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.2 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- F. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
 - 1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
- G. Install slip sheet over cover board and immediately beneath membrane roofing.

3.3 MECHANICALLY FASTENED MEMBRANE ROOFING INSTALLATION

- A. Mechanically fasten membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
- B. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- D. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- E. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten TPO sheet to roof deck.
- F. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

3.4 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.5 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

END OF SECTION 07542

SECTION 07620 - SHEET METAL FLASHING AND TRIM**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes sheet metal flashing and trim in the following categories:
 - 1. Roof-drainage systems.
 - 2. Exposed trim, gravel stops, and fasciae.
 - 3. Copings.
 - 4. Metal flashing.
 - 5. Reglets.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Joint Sealants" for elastomeric sealants.
 - 2. Division 7 Roofing Sections for flashing and roofing accessories installed integral with roofing membrane as part of roofing-system work.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
- C. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.
- 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.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

- A. Galvanized Steel Sheet: ASTM A 526, G 90 (ASTM A 526M, Z 275), commercial quality, or ASTM A 527, G 90 (ASTM A 527M, Z 275), lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 0.0396 inch (1.0 mm) thick, unless otherwise indicated.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ-50 coating, Grade 40 (ASTM A 792M, Class AZ-150 coating, Grade 275) or to suit project conditions, with 55 percent aluminum, not less than 0.0396 inch (1.0 mm) thick, unless otherwise indicated.

2.2 REGLETS

- A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.
- B. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- C. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
- D. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
- E. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
- F. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.
 - 1. Material: Aluminum, 0.024 inch (0.6 mm) thick.
 - 2. Material: Galvanized steel, 0.0217 inch (0.55 mm) thick.
- G. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fry Reglet Corporation.

2.3 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Burning Rod for Lead: Same composition as lead sheet.
- B. Solder: ASTM B 32, Grade Sn50, used with rosin flux.
- C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.
- D. Stainless-Steel Welding Rods: Type recommended by stainless-steel sheet manufacturer for type of metal sheets furnished.
- E. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- F. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.
- G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- H. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."
- I. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.
- J. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- K. Paper Slip Sheet: 5-lb/square (0.244 kg/sq. m) red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.
- L. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil- (0.15-mm-) thick black polyethylene film, resistant to decay when tested according to ASTM E 154.
- M. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.
- N. Gutter Screen: 1/4-inch (6-mm) hardware cloth installed in sheet metal frames. Fabricate screen and frame of same basic material as gutters and downspouts.
- O. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.4 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

- C. Form 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.
- D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- F. Expansion Provisions: Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- G. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- H. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.
- I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- J. 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 never less than thickness of metal being secured.

2.5 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Roof-Drain Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.0156 inch (0.4 mm) thick.
 - 2. Terne-Coated Stainless Steel: 0.015 inch (0.4 mm) thick.
- C. Scuppers: Fabricate from the following material:
 - 1. Galvanized Steel: 0.0276 inch (0.7 mm) thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch (0.7 mm) thick.
 - 3. Coil-Coated Galvanized Steel: 0.0276 inch (0.7 mm) thick.
- D. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:
 - 1. Galvanized Steel: 0.0276 inch (0.7 mm) thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch (0.7 mm) thick.
 - 3. Coil-Coated Galvanized Steel: 0.0276 inch (0.7 mm) thick.
- E. Copings: Fabricate from the following material:

1. Galvanized Steel: 0.0396 inch (1.0 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch (1.0 mm) thick.
3. Coil-Coated Galvanized Steel: 0.0396 inch (1.0 mm) thick.

F. Base Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0276 inch (0.7 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch (0.7 mm) thick.
3. Coil-Coated Galvanized Steel: 0.0276 inch (0.7 mm) thick.

G. Counterflashing: Fabricate from the following material:

1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick.
3. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.

H. Flashing Receivers: Fabricate from the following material:

1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick.
3. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.

I. Drip Edges: Fabricate from the following material:

1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick.
3. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.

J. Eave Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick.
3. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.

K. Equipment Support Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick.
3. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.

2.6 COIL-COATED GALVANIZED STEEL SHEET FINISH

A. High-Performance Organic Coating Finish: Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.

1. 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.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

- b. Resin Manufacturers: Subject to compliance with requirements, provide fluoropolymer coating systems containing resins produced by one of the following manufacturers:
 - 1) Ausimont USA, Inc. (Hylar 5000)
 - 2) Elf Atochem North America, Inc. (Kynar 500)
- 2. Coil-Coated Steel Sheet Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Atas Aluminum Corporation.
 - b. Copper Sales, Inc.
 - c. MM Systems Corporation.
 - d. Petersen Aluminum Corporation.
 - e. Vincent Metals.
- B. Shop Finish, Rain Drainage: Provide manufacturer's standard baked-on, white-acrylic shop finish on sheet metal rain-drainage units (gutters, downspouts, and similar exposed units); 1.0-mil (0.025-mm) dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." 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. Roof-Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.
- D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

- E. 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 (38 mm), except where pre-tinned surface would show in finished Work.
1. Do not solder the following metals:
 - a. Aluminum.
 - b. Coil-coated galvanized steel sheet.
 2. Pre-tinning is not required for the following metals:
 - a. Lead.
 - b. Lead-coated copper.
 - c. Terne-coated stainless steel.
 3. 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.
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
1. Use joint adhesive for nonmoving joints specified not to be soldered.
- G. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- I. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.
 2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.
- J. Install reglets to receive counterflashing according to the following requirements:
1. Where reglets are shown in concrete, furnish reglets for installation under Division 3 Section "Cast-in-Place Concrete."
 2. Where reglets are shown in masonry, furnish reglets for installation under Division 4 Section "Unit Masonry."
- K. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.
- L. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the item manufacturer, to drain

roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items for steep-sloped roofs with roofing installation.

- M. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.
- N. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.
- O. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:
 - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 - 2. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.
- P. Splash Pans: Install where downspouts discharge on low-sloped roofs, unless otherwise shown. Set in roof cement or sealant compatible with roofing membrane.
- Q. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.

3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07620

SECTION 07720 - ROOF HATCHES (BILCO TYPE S)**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
- B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
- C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer: A minimum of 5 years' experience manufacturing similar products.
- B. Installer: A minimum of 2 years' experience installing similar products.
- C. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.6 WARRANTY

- A. **Manufacturer's Warranty:** Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. **Basis-of-Design Manufacturer:** Type S-40 Roof Hatch by The Bilco Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-933-8478, Web: www.bilco.com.

2.2 ROOF HATCH

- A. Furnish and install where indicated on plans metal roof hatch Type S-40, size width: 36" (914mm) x length: 30" (762mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.
- B. **Performance characteristics:**
 - 1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span, hatches with an aluminum cover and galvanized steel curb (Type S-40)].
 - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - 3. Operation of the cover shall not be affected by temperature.
 - 4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
- C. **Curb:** Shall be 12" (305mm) in height and of 14 gauge (1.9mm) paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip[®] flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.
- D. **Curb insulation:** Shall be rigid, high-density fiberboard of 1" (25mm) thickness on outside of curb.
- E. **Lifting mechanisms:** Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe; for steel construction: through bolted to the curb assembly.

F. Hardware

1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with a spring latch with interior and exterior turn handles
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

G. Finishes: Factory finish shall be mill finish aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
1. Test units for proper function and adjust until proper operation is achieved.
 2. Repair finishes damaged during installation.
 3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION 07720

SECTION 07810 - PLASTIC UNIT SKYLIGHTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes plastic unit skylights.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 6 Section "Rough Carpentry" for wood curbs and nailers.
 - 2. Division 7 Section "Flashing and Sheet Metal" for metal flashing for skylights.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of skylight specified, including details of construction relative to materials, dimensions of individual components, profiles, finishes, and glazing light transmission and thermal characteristics.
- C. Shop drawings showing fabrication and installation of skylights, including plans, elevations, sections, details of components, and attachments to other units of Work.
- D. Samples for initial selection purposes in the form of manufacturer's color charts showing a full range of colors available for each type of skylight glazing, retainer, frame, and curb indicated.
- E. Samples for verification purposes in full-size units or a representative section of each type of skylight indicated for each color, texture, shape, and sizes specified.

1.4 WARRANTY

- A. General: Warranties specified in this Section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Skylight Warranty: Provide written warranty signed by manufacturer, agreeing to repair or replace work that exhibits defects in materials or workmanship and guaranteeing weathertight and leak-free performance. "Defects" is defined as uncontrolled leakage of water and abnormal aging or deterioration.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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. SKYCO Skylights.
 - a. Model: S-LV9-CM-SP, Skypro Illuminator, Steel curb mounted vortex louvered skypro skywave single dome skylight.

2.2 MATERIALS

- A. Aluminum Sheets: ASTM B 209 (ASTM B 209M) for Alclad alloy 3005-H25 or alloy and temper required to suit forming operations and finish requirements. Mill finish unless indicated otherwise.
- B. Extruded Aluminum: ASTM B 221 (ASTM B 221M) alloy 6063-T52 or alloy and temper required to suit structural and finish requirements. Mill finish unless indicated otherwise.
- C. Plastic Sheets: Monolithic, formable, transparent (colorless and tinted) or translucent (white) sheets with good weather and impact resistance.
1. Acrylic: ASTM D 4802, thermoformable, cast or continuous-cast acrylic (methacrylate), Category C-1 or C-2, Type UVA (formulated with ultraviolet absorber), with Finish 1 (smooth or polished), unless otherwise indicated.
 2. Polycarbonate: Thermoformable, monolithic polycarbonate sheets manufactured by the extrusion process, UV resistant, burglar resistance rated per UL 972 with average impact strength of 12 to 16 ft-lb/inch (638 to 850 J/m) of width when tested according to ASTM D 256, Test Method A (Izod).
- D. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thicknesses indicated.
- E. Wood Curbs and Nailers: Softwood lumber, pressure-treated with waterborne preservatives for above-ground use, complying with AWWA C2; not less than 1-1/2 inch (38 mm) nominal thickness.
- F. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.
1. Where removal of exterior exposed fasteners affords access to building, provide nonremovable fastener heads.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4 mm) dry film thickness per coating.
- H. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

- I. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces. ASTM C 920; Type S; Grade NS; Class 25; and Uses NT, G, A, and (as applicable to joint substrates indicated) O.
- J. Roofing Cement: ASTM D 4586, nonasbestos-fibrated, asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.3 FINISHES

- A. General: Comply with NAAMM "Metal Finishes Manual" recommendations for application and designations of finishes.
- B. Finish designations prefixed by AA conform to the system for designating aluminum finishes established by the Aluminum Association.
- C. Class I, Clear-Anodized Finish: AA-C22A41 (Chemical Finish: etched, medium matte; Anodic Coating: Class I Architectural, clear film thicker than 0.7 mil (0.02 mm)) complying with AAMA 607.1.

2.4 PLASTIC SKYLIGHT UNITS

- A. General: Factory-assembled unit consisting of plastic glazing, extruded aluminum glazing retainer, gasketing, inner frame designed to mount on separate curb, and self-contained flashing.
- B. Curb: Vented. Nominal 1-1/2-inch (38-mm) thick wood curbs with cants or formed flashing flange to receive roof flashing and counterflashing.
- C. Shape and Size: As indicated on Plans
- D. Glazing: Thermoformed polycarbonate.
 - 1. Sheet Thicknesses: Provide glazing plastic sheet thickness required for 40 lbf/sq. ft. (1.9 kPa) positive (external) loading and 20 lbf/sq. ft. (0.95 kPa) negative or uplift (internal) loading as recommended by the skylight manufacturer for unit size and shape.
 - 2. Glazing Gaskets: Manufacturer's standard glazing system of EPDM or neoprene, closed-cell sponge neoprene, or EPDM, or of partially vulcanized butyl tape or liquid-applied elastomeric sealant.
- E. Security: Equip each unit with security grille.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive skylight units. Coordinate with installation of vapor barriers, roof insulation, roofing, and flashing as required to assure that each element of the work performs properly and that combined elements are waterproof and

weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

1. Except as otherwise indicated, install roof skylights according to construction details of "NRCA Roofing and Waterproofing Manual."
- B. Isolation: Where metal surfaces of units are to be installed in contact with incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide another permanent separation.
- C. Flange Seals: Except as otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.
- D. Cap Flashing: Where cap flashing is required as component of the skylight, install to provide an adequate waterproof overlap with roofing or roof flashing (as counterflashing). Seal with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.
- E. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.2 CLEANING AND PROTECTION

- A. Clean exposed metal and plastic surfaces according to manufacturer's instructions. Touch up damaged metal coatings.
- B. Clean and polish plastic skylight units, inside and out, not more than 5 days prior to date of substantial completion.

END OF SECTION 07810

SECTION 07901 - JOINT SEALANTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the following locations:

1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:

- a. Control and expansion joints in unit masonry.
- b. Control and expansion joints in ceiling and overhead surfaces.
- c. Other joints as indicated.

2. Exterior joints in horizontal traffic surfaces as indicated below:

- a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
- b. Tile control and expansion joints.
- c. Joints between different materials listed above.
- d. Other joints as indicated.

3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:

- a. Control and expansion joints on exposed interior surfaces of exterior walls.
- b. Perimeter joints of exterior openings where indicated.
- c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
- d. Perimeter joints of toilet fixtures.
- e. Other joints as indicated.

4. Interior joints in horizontal traffic surfaces as indicated below:

- a. Control and expansion joints in cast-in-place concrete slabs.
- b. Control and expansion joints in tile flooring.
- c. Other joints as indicated.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Flashing, Trim and Sheet Metal" for sealing joints related to flashing and sheet metal for roofing.
2. Division 8 "Glazing" for sealants used in glazing.
3. Division 9 Section "Gypsum Board Assemblies" for sealing concealed perimeter joints of gypsum board partitions to reduce sound transmission.
4. Division 9 Section "Ceramic Tile" for sealing tile joints.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data from manufacturers for each joint sealant product required.
 - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
- C. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
- D. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.
- C. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4 deg C).
 - 3. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
 - 2. Provide colors of exposed joint sealers to match adjacent surfaces.
- C. Manufacturers: subject to compliance with requirements, manufacturers providing products which may be incorporated to the project include, but are not limited to:
 - 1. Dow corning.
 - 2. General electric co.
 - 3. Tremco.

2.2 SEALANT MATERIALS

- A. TYPE I sealant: Acrylic base, single component, solvent curing; capable of being continuously immersed in water, withstand movement of up to 7.5 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees f; shore a hardness of maximum 5; nonstaining, nonbleeding, nonsagging.
 - 1. Sonolac manufactured by Sonneborn Chemstruction Systems.

- B. TYPE II sealant: Polyurethane base, multi-component, chemical curing; self-levelling type for application in horizontal joints; capable of being continuously immersed in water, withstand movement of up to 25 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees f; uniform, homogeneous, and free from lumps, skins, and coarse particles when mixed; shore a hardness of minimum 25 and maximum 35; nonstaining, nonbleeding, color as selected.
 - 1. THC-900 manufactured by tremco.
- C. TYPE III sealant: Polyurethane base, multi-component, chemical curing; non-sagging type for application in vertical joints; withstand movement of up to 40 percent of joint width and satisfactorily applied throughout a temperature range of 40 to 80 degrees f; shore a hardness of minimum 25 and maximum 35; nonsagging, nonbleeding, color as selected.
 - 1. Dymeric manufactured by Tremco.

2.9 MISCELLANEOUS MATERIALS

- 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 in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 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 joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer 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. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 2. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
 3. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

3.6 JOINT SEALANTS SCHEDULE:

TYPE I:	Glass to metal.
TYPE III:	Metal to metal.
TYPE I:	Gypsum board to gypsum board.
TYPE I:	Gypsum board to dissimilar material.
TYPE II:	Horizontal joints in floors and paving.
TYPE III:	Masonry to masonry.
TYPE III:	Masonry to metal.
TYPE I:	Wood to wood.
TYPE I:	Wood to masonry
TYPE I:	Wood to metal.

END OF SECTION 07901

SECTION 07905 - PAVING JOINT SEALANTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the following:
 - 1. Joints between portland cement concrete paving and asphalt paving.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 2 Section "Portland Cement Concrete Paving" for construction of joints in concrete paving.
 - 3. Division 7 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data from manufacturers for each joint sealant product required.
 - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
- C. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
- D. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
- E. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

- B. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.
- C. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4 deg C).
 - 3. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Silicone Sealant for Concrete and Asphalt: One-part, low-modulus, neutral-cure silicone sealant complying with ASTM C 920, Type S, Grade P, Class 25, and Uses T, M, and as applicable to joints with concrete and asphalt substrates, O and with the following requirements:
1. Additional capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage changes in joint width as measured at time of application and remain in compliance with other requirements of ASTM C 920 for Uses indicated:
 - a. 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.
- B. Two-Part, Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation composed of reactive petropolymer and activator components producing a pourable, self-leveling sealant with the following physical properties measured per ASTM D 3407, with modifications as noted:
1. Penetration with 150-gram cone after 5 seconds:
 - a. At 77 deg F (25 deg C): 1.3 mm plus or minus 0.2 mm.
 - b. At 0 deg F (-18 deg C): 1.5 mm minimum.
 - 1) Modification: Specimen conditioned 24 hours at 0 deg F (-18 deg C).
 2. Flow at 140 deg F (60 deg C): 0.3 cm maximum.
 3. Resilience at 77 deg F (25 deg C): 75 percent minimum.
 - a. Modification: Ball penetrometer coated with talc, no glycerine.
 4. Elongation at -20 deg F (-29 deg C): 300 percent minimum.
 - a. Modification: Specimen changed to 1/2 x 1/2 x 2 inches (13 x 13 x 50 mm) and extended 1-1/2 inches (38 mm) for one cycle.
 5. Bond at -20 deg F (-29 deg C): Passes 3 cycles.
 - a. Modification: Standard specimen extended 100 percent of original width.
- C. Available Products: Subject to compliance with requirements, cold-applied joint sealants that may be incorporated in the Work include, but are not limited to, the following:
1. Silicone Sealant for Concrete and Asphalt:
 - a. "Dow Corning 890-SL," Dow Corning Corp.
 2. Two-Part, Low-Modulus Sealant for Concrete and Asphalt:
 - a. "Cold-Applied SOF-SEAL," W.R. Meadows, Inc.

2.3 HOT-APPLIED JOINT SEALANTS

- A. Sealant for Concrete and Asphalt: One-part formulation complying with ASTM D 3405.
- B. Low-Modulus Sealant for Concrete and Asphalt: Proprietary, pourable petropolymer formulation with the following physical properties measured per ASTM D 3407 with modifications to test methods noted:

1. Penetration with 150-gram cone after 5 seconds:
 - a. At 77 deg F (25 deg C): 1.2 mm plus or minus 0.2 mm.
 - b. At 0 deg F (-18 deg C): 0.4 mm minimum.
 - 1) Modification: Specimen conditioned 24 hours at 0 deg F (-18 deg C).
 2. Flow at 140 deg F (60 deg C): 0.3 cm maximum.
 3. Resilience at 77 deg F (25 deg C): 60 percent minimum.
 - a. Modification: Ball penetrometer coated with talc, no glycerine.
 4. Elongation:
 - a. At 77 deg F (25 deg C): 600 percent minimum.
 - 1) Modification: Specimen changed to 3/4 x 3/4 x 2 inches (19 x 19 x 50 mm).
 - b. At -20 deg F (-29 deg C): 300 percent.
 - 1) Modification: Specimen changed to 1/2 x 1/2 x 2 inches (13 x 13 x 50 mm) and extended 1-1/2 inches (38 mm) for one cycle.
 5. Bond at -20 deg F (-29 deg C): Passes 3 cycles.
 - a. Modification: Standard specimen extended 100 percent of original width without separating development of any cracks or other opening over 1/4 inch (6 mm) deep.
- C. Available Products: Subject to compliance with requirements, hot-applied joint sealants that may be incorporated in the Work include, but are not limited to, the following:
1. Sealant for Concrete and Asphalt:
 - a. "ROADSAVER 221," Crafcro Inc.
 - b. "Product #9005," Koch Materials Co.
 - c. "Product #9030," Koch Materials Co.
 - d. "SEALTIGHT HI-SPEC," W.R. Meadows, Inc.
 2. Low-Modulus Sealant for Concrete and Asphalt:
 - a. "SEALTIGHT SOF-SEAL," W.R. Meadows, Inc.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Backer Rods for Cold-Applied Sealants: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible, plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, and nonoutgassing in unruptured state.
 2. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf (40 kg/cu m) and tensile strength of 35 psi (240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
 3. Either material indicated above.
- C. Backer Rods for Hot-Applied Sealants: Crosslinked, closed-cell polyolefin foam or polyethylene foam, nonoutgassing, nonstaining, and capable of withstanding high temperatures of hot-applied joint sealants.
1. Available Products: Subject to compliance with requirements, backer rods for hot-applied sealants that may be incorporated in the Work include, but are not limited to, the following:
 - a. "HBR XL," Applied Extrusion Technologies., Inc.
 - b. "SEALTIGHT CERA-ROD," W.R. Meadows, Inc.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

- 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.

PART 3 - EXECUTION

3.1 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 joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- F. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

END OF SECTION 07905

SECTION 08110 - STEEL DOORS AND FRAMES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes steel doors and frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 8 Section "Door Hardware" for door hardware and weatherstripping.
 - 2. Division 9 Section "Gypsum Board Assemblies" for spot grouting frames in gypsum board partitions.
 - 3. Division 9 Section "Painting" for field painting primed doors and frames.

1.3 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 door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
- D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
 - 1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

- B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 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. Steel Doors and Frames:
 - a. Amweld Building Products, Inc.
 - b. Benchmark Commercial Doors.
 - c. Ceco Door Products.
 - d. Copco Door Co.
 - e. Curries Co.
 - f. Deansteel Manufacturing Co.
 - g. Fenestra Corp.
 - h. Kewanee Corp.
 - i. Mesker Door, Inc.
 - j. Pioneer Industries.
 - k. Republic Builders Products.
 - l. Steelcraft.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets and Strip: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 569 (ASTM A 569M).
- B. Cold-Rolled Steel Sheets: Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special killed.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60 (ASTM A 525M, with Z 180 or ZF 180) coating designation, mill phosphatized.
- D. Supports and Anchors: Fabricated from not less than 0.0478-inch- (1.2-mm-) thick steel sheet; 0.0516-inch- (1.3-mm-) thick galvanized steel where used with galvanized steel frames.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.3 DOORS

- A. Steel Doors: Provide 1-3/4-inch- (44-mm-) thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:
 - 1. Exterior Doors: Grade II, heavy-duty, Model 1, full flush design, minimum 0.0516-inch- (1.3-mm-) thick galvanized steel sheet faces.

2.4 FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 0.0478-inch- (1.2-mm-) thick cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners, continuously welded construction for exterior applications and knocked down for field assembly at interior applications.
 - 2. Form exterior frames from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.
- C. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry."

2.5 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
 - 1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
 - a. Resin-impregnated paper honeycomb.
 - b. Rigid polyurethane conforming to ASTM C 591.
 - c. Rigid polystyrene conforming to ASTM C 578.
 - d. Unitized steel grid.
 - e. Vertical steel stiffeners.
 - f. Rigid mineral fiber with internal sound deadener on inside of face sheets.
 - 2. Clearances: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between non-fire-rated pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
 - a. Fire Doors: Provide clearances according to NFPA 80.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.
- C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

- D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- E. Galvanized Steel Doors, Panels, and Frames: For the following locations, fabricate doors, panels, and frames from galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 0.0635-inch- (1.6-mm-) thick galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.
 - 1. At exterior locations and where indicated.
- F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- G. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.
 - 1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.
- H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- I. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- J. Glazing Stops: Minimum 0.0359-inch- (0.9-mm-) thick steel or 0.040-inch- (1-mm-) thick aluminum.
 - 1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 - 2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.
- C. Apply primers and organic finishes to doors and frames after fabrication.

2.7 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating 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 regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.
 1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.
- C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.0254 mm) for topcoat. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.0508 mm).
 1. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

2.8 STEEL SHEET FINISHES

- A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).
- B. Pretreatment: Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.
- C. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.
- D. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat that complies with ANSI A250.3. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.0508 mm).
 1. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
 4. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
 5. In in-place gypsum board partitions, install knock-down, slip-on, drywall frames.
- C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.

3.2 ADJUSTING AND CLEANING

- A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08331 - OVERHEAD COILING DOORS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of overhead coiling doors:
 - 1. Service doors.
- B. Related Sections include the following:
 - 1. Division 9 Section "Painting" for field-applied paint finish.
 - 2. Division 16 Section "Disconnect Switches and Circuit Breakers" for disconnect switches and circuit breakers for powered operators.

1.3 DEFINITIONS

- A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.
- B. Operation-Cycle Requirements: Design overhead coiling door components and operator to operate for not less than 10,000 cycles.
 - 1. Include tamperproof cycle counter.

1.5 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
 - 1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.

2. Summary of forces and loads on walls and jambs.
 3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
 4. Fire-Rated Doors: Information describing fire-release system, including testing and resetting instructions.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.
- D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
1. Obtain operators and controls from the overhead coiling door manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
1. Airlift Doors, Inc.
 - a). Product: XRS Vinyl roll-up door, Elite Plus
 - b). Product: Alaska Polycarbonate Overhead Door

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
- B. Endlocks: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

- C. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, either stainless-steel or aluminum extrusions to suit type of curtain slats.
- D. Curtain Jamb Guides: Fabricate curtain jamb guides of angles, or channels and angles of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel and removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

- A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weatherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
 - 1. Fabricate steel hoods, for steel doors, of not less than 0.028-inch (0.7-mm) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653 (ASTM A 653M).
 - 3. Include automatic drop baffle to guard against passage of smoke or flame.
 - 4. Shape: Round.
- B. Integral Frame, Hood, and Fascia: Provide welded assemblies of the following sheet metal:
 - 1. Fabricate of not less than 0.064-inch- (1.6-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653 (ASTM A 653M).
- C. Integral Sills: Fabricate sills as integral part of frame assembly of same sheet metal, but not less than 0.078 inch (2.0 mm) thick.
- D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
 - 1. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.
- E. Slide Bolt: Fabricate with side locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- F. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
 - 3. Locking Bars: Single-jamb side, operable from inside and outside.
- G. Chain Lock Keeper: Suitable for padlock.
- H. Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with

required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.5 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

END OF SECTION 08331

SECTION 08410 - ALUMINUM ENTRANCES AND STOREFRONTS**PART 1 – GENERAL****1.1 WORK INCLUDED**

- A. Furnish and install aluminum architectural storefront system complete with hardware and related components as shown on drawings and specified in this section.
- B. Glass
 - 1. Reference Section 08800 for Glass and Glazing.
- C. Single Source Requirement
 - 1. All products listed in Section 1.02 shall be by the same manufacturer.

1.2 RELATED WORK

- B. Related sections include the following:
 - 1. Division 7 Section "Joint Sealants" for joint sealants installed as part of aluminum entrance and storefront systems.
 - 2. Division 8 Section "Glazing."
 - . Division 8 Section "Glazed Aluminum Curtain Walls."

1.3 LABORATORY TESTING AND PERFORMANCE REQUIREMENTS

- A. Test Units
 - 1. Air, water, and structural test unit size shall be a minimum of two stories high and three lites wide.
 - 2. Thermal test unit sizes shall be 80" (2032 mm) wide x 80" (2032 mm) high with one intermediate vertical mullion and two lites of glass.
- B. Test Procedures and Performance
 - 1. Air Infiltration Test
 - a. Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (299 Pa).
 - b. Air infiltration shall not exceed .06 cfm/SF (.30 l/s•m²) of unit.
 - 2. Water Resistance Test
 - a. Test unit in accordance with ASTM E 331.
 - b. There shall be no uncontrolled water leakage at a static test pressure of 10.0 psf (479 Pa).
 - 3. Uniform Load Deflection Test

- a. Test in accordance with ASTM E 330.
 - b. Deflection under design load shall not exceed $L/175$ of the clear span.
4. Uniform Load Structural Test
- a. Test in accordance with ASTM E 330 at a pressure 1.5 times the design wind pressure in 1.05.B.3.b.
 - b. At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, storefront parts, or any other damage that would cause the storefront to be defective.
- C. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.
1. Deflection of framing members in a direction normal to wall plane is limited to $1/175$ of clear span or $3/4$ inch (19 mm), whichever is smaller, unless otherwise indicated.
 2. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.
 - a. Test Pressure: 150 percent of inward and outward wind-load design pressures.
 - b. Duration: As required by design wind velocity; fastest 1 mile (1.609 km) of wind for relevant exposure category.
- 1.4 FIELD TESTING AND PERFORMANCE REQUIREMENTS
- A. Test in accordance with AAMA 501.2 for spray test only or AAMA 503.92 for pressurized test.
- 1.5 QUALITY ASSURANCE
- A. Provide test reports from AAMA accredited laboratories certifying the performance as specified in 1.05.
 - B. Test reports shall be accompanied by the storefront manufacturer's letter of certification stating that the tested storefront meets or exceeds the referenced criteria for the appropriate storefront type.
- 1.6 SUBMITTALS
- A. Contractor shall submit shop drawings; finish samples, test reports, and warranties.
 1. Samples of materials as may be requested without cost to owner, i.e., metal, glass, fasteners, anchors, frame sections, mullion section, corner section, etc.
 - B. An NFRC Component Modeling Approach (CMA) generated label certificate shall be provided by the manufacturer. The label certificate shall be project specific and will contain the thermal performance ratings of the manufacturer's framing combined with the specified glass, and the glass spacer used in the fabrication of the glass, at NFRC standard test size as defined in table 4-3 in NFRC 100-2010.

1.7 WARRANTIES

A. Total Storefront Installation.

1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total storefront installation. This includes the glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc., as it relates to air, water and structural adequacy as called for in the specifications and approved shop drawings.
2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at their expense during the warranty period.

B. Window Material and Workmanship

1. Provide written guarantee against defects in material and workmanship for 10 years from the date of final shipment.

C. Glass

1. Provide written warranty for insulated glass units that they will be free from obstruction of vision as a result of dust or film formation on the internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship.
2. Warranty period shall be for 10 (ten) years.

D. Finish

1. Warranty period shall be for 10 years from the date of final shipment.
2. Provide organic finish warranty based on AAMA standard 2604.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. All storefront systems shall be EFCO System 406X Dual-Thermal Flush-Glazed Screw Spline Storefront. Other manufacturers requesting approval to bid their product as an equal must submit the following information fifteen days prior to close of bidding.
 - a). Sample storefront system (size and configuration) as per requirements of architect.
 - b). Test reports.
 2. Entrance swing doors; EFCO 1-3/4" Standard Aluminum Swing Entrance Doors, Series D300 SF Medium Style.

2.2 MATERIALS

A. Aluminum

1. Extruded aluminum shall be 6063-T6 alloy and temper.

B. Thermal Barrier

1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.
2. Barrier material shall be poured-in-place, two-part polyurethane. A nonstructural thermal barrier is unacceptable.

2.3 FABRICATION**A. General**

1. All aluminum frame extrusions shall have a minimum wall thickness of .080" (2 mm).
2. All exposed work shall be carefully matched to produce continuity of line and design with all joints. System design shall be such that raw edges will not be visible at joints.

B. Frame

1. Depth of frame shall not be less than 6 1/2" (165 mm).
2. Face dimension shall not be less than 2" (50 mm).
3. Frame components shall be screw spline construction.

C. Glazing

1. All units shall be "dry glazed" with gaskets on both exterior and interior of the glass.

D. Finish

1. Organic, color as selected by Architect.

PART 3 - EXECUTION**3.1 INSPECTION****A. Job Conditions**

1. All openings shall be prepared by others to the proper size and shall be plumb, level and in the proper location and alignment as shown on the architect's drawings.

3.2 INSTALLATION

- A. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications.
- B. Storefront system shall be erected plumb and true, in proper alignment and relation to established lines and grades.
- C. Entrance doors shall be securely anchored in place to a straight, plumb and level condition, without distortion. Weather stripping contact and hardware movement shall be checked and final adjustments made for proper operation and performance of units.

- D. Furnish and apply sealing materials to provide a weather tight installation at all joints and intersections and at opening perimeters.
- E. Sealing materials specified shall be used in strict accordance with the manufacturer's printed instructions, and shall be applied only by mechanics specially trained or experienced in their use. All surfaces must be clean and free of foreign matter before applying sealing materials. Sealing compounds shall be tooled to fill the joint and provide a smooth finished surface.

3.3 ANCHORAGE

- A. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

3.4 PROTECTION AND CLEANING

- A. The general contractor shall protect the aluminum materials and finish against damage from construction activities and harmful substances. The general contractor shall remove any protective coatings as directed by the architect, and shall clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION 08410

SECTION 08710 - DOOR HARDWARE**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

- B. This Section includes the following:

1. Hinges.
2. Pivots.
3. Lock cylinders and keys.
4. Lock and latch sets.
5. Bolts.
6. Exit devices.
7. Push/pull units.
8. Closers.
9. Weatherstripping for exterior doors.
10. Sound stripping for interior doors.
11. Thresholds.

- C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section "Steel Doors and Frames" for silencers integral with hollow metal frames.
2. Division 8 Section "Flush Wood Doors" for factory prefitting and factory premachining of doors for door hardware.

1.3 HARDWARE ALLOWANCE

- A. Door hardware supplier's responsibilities shall be as follows:

1. Submittals: Submit through Contractor required product data, final hardware schedule, separate keying schedule, and samples as specified in this Section, unless otherwise indicated.
2. Construction Schedule: Inform Contractor promptly of estimated times 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 data in construction schedule. Comply with this schedule.
3. Coordination and Templates: Assist Contractor as required to coordinate hardware with other work in respect to both fabrication and installation. Furnish Contractor with templates and deliver hardware to proper locations.

4. Product Handling: Package, identify, deliver, and inventory door hardware specified in this Section.
5. Discrepancies: Based on requirements indicated in Contract Documents in effect at time of door hardware selection, furnish types, finishes, and quantities of door hardware, including fasteners, and Owner's maintenance tools required to comply with specified requirements and as needed to install and maintain hardware. Furnish or replace any items of door hardware resulting from shortages and incorrect items at no cost to the Owner or Contractor. Obtain signed receipts from Contractor for all delivered materials.

B. Contractor's responsibilities shall be as follows:

1. Submittals: Coordinate and process submittals for door hardware in same manner as submittals for other work.
2. Construction Schedule: Cooperate with door hardware supplier in establishing scheduled dates for submittals and delivery of templates and door hardware. Incorporate in construction schedule the times and dates related to furnishing hardware by door hardware supplier.
3. Coordination: Coordinate door hardware with other Work. Furnish hardware supplier or manufacturer with shop drawings of other work where required or requested. Verify completeness and suitability of hardware with supplier.
4. Product Handling: Provide secure lock-up for hardware delivered to the site. Inventory hardware jointly with representative of hardware supplier and issue signed receipts for all delivered materials.
5. Installation Information: The general types and approximate quantities of hardware required for this Project are indicated at the end of this Section in order to establish Contractor's costs for installation and other work not included in allowance.
6. No adjustments in Contract sum will be made for costs other than those covered by the allowances for subsequent increases or decreases in quantity of one or more hardware types that do not exceed 5 percent.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.
- B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, function, size, and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.

2. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
 1. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.

1.6 PRODUCT HANDLING

- A. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- B. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

1.7 MAINTENANCE

- A. Maintenance Tools and Instructions: 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.

PART 2 - PRODUCTS

2.1 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. Butts and Hinges:
 - a. Bommer Industries, Inc.
 - b. Cal-Royal Products, Inc.
 - c. Hager Hinge Co.
 - d. Lawrence Brothers, Inc.
 - e. McKinney Products Co.
 - f. H. Soss & Company.
 - g. Stanley Hardware, Div. Stanley Works.
 2. Pivots:

- a. Glynn-Johnson Corp.
 - b. Hager Hinge Co.
 - c. LCN, Div. Ingersoll-Rand Door Hardware Group.
 - d. Norton Door Controls, Div. Yale Security Inc.
 - e. Rixson-Firemark, Div. Yale Security Inc.
 - f. Stanley Hardware, Div. Stanley Works.
3. Cylinders and Locks:
- a. Arrow Lock Manufacturing Co.
 - b. Best Lock Corp.
 - c. Corbin & Russwin Architectural Hardware, Div. Black & Decker Corp.
 - d. Falcon Lock Co.
 - e. Sargent Manufacturing Company.
 - f. Schlage Lock, Div. Ingersoll-Rand Door Hardware Group.
 - g. Yale Security Inc.
4. Bolts:
- a. Builders Brass Works Corp.
 - b. Glynn-Johnson Corp.
 - c. Hager Hinge Co.
 - d. H. B. Ives, A Harrow Company.
 - e. Quality Hardware Mfg. Co., Inc.; Div. Newman Tonks, Inc.
 - f. Stanley Hardware, Div. Stanley Works.
5. Exit/Panic Devices:
- a. Adams Rite Manufacturing Co.
 - b. Arrow Lock Manufacturing Co.
 - c. Corbin & Russwin Architectural Hardware, Div. Black & Decker Corp.
 - d. Dor-O-Matic.
 - e. Monarch Hardware & Mfg. Co., Div Newman Tonks, Inc.
 - f. Precision Hardware, Inc.
 - g. Reed Exit Hardware, Div. Yale Security Inc.
 - h. Sargent Manufacturing Company.
 - i. Von Duprin, Div. Ingersoll-Rand Door Hardware Group.
 - j. Yale Security Inc.
6. Push/Pull Units:
- a. Baldwin Hardware Corp.
 - b. Brookline Industries, Div. Yale Security Inc.
 - c. Corbin & Russwin Architectural Hardware, Div. Black & Decker Corp.
 - d. Hager Hinge Co.
 - e. Hiawatha, Inc.
 - f. H. B. Ives, A Harrow Company.
 - g. Triangle Brass Manufacturing Company (Trimco).
7. Overhead Closers:
- a. Arrow Lock Manufacturing Co.
 - b. Corbin & Russwin Architectural Hardware, Div. Black & Decker Corp.
 - c. Dorma Door Controls International.
 - d. International Door Closers, Inc.
 - e. LCN, Div. Ingersoll-Rand Door Hardware Group.

- f. Monarch Hardware & Mfg. Co., Div Newman Tonks, Inc.
- g. Norton Door Controls, Div. Yale Security Inc.
- h. Rixson-Firemark, Div. Yale Security Inc.
- i. Sargent Manufacturing Company.
- j. Yale Security Inc.

8. Door Stripping and Seals:

- a. Hager Hinge Co.
- b. National Guard Products, Inc.
- c. Pemko Manufacturing Co., Inc.
- d. Reese Enterprises, Inc.
- e. Sealeze Corp.
- f. Ultra Industries.
- g. Zero International, Inc.

9. Thresholds:

- a. Hager Hinge Co.
- b. National Guard Products, Inc.
- c. Pemko Manufacturing Co., Inc.
- d. Reese Enterprises, Inc.
- e. Sealeze Corp.
- f. Zero International, Inc.

10. Sound Stripping:

- a. National Guard Products, Inc.
- b. Pemko Manufacturing Co., Inc.
- c. Reese Enterprises, Inc.
- d. Zero International, Inc.

2.2 MATERIALS AND FABRICATION

- A. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.
- B. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

2.3 HINGES, BUTTS, AND PIVOTS

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Screws: Provide Phillips flat-head screws complying with the following requirements:

1. For metal doors and frames install machine screws into drilled and tapped holes.
2. For wood doors and frames install wood screws.
3. For fire-rated wood doors install #12 x 1-1/4-inch (32-mm), threaded-to-the-head steel wood screws.
4. Finish screw heads to match surface of hinges or pivots.

C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

1. Out-Swing Exterior Doors: Nonremovable pins.
2. Out-Swing Corridor Doors with Locks: Nonremovable pins.
3. Interior Doors: Nonrising pins.
4. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.

D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90 inches (2250 mm) or less in height and one additional hinge for each 30 inches (750 mm) of additional height.

1. Fire-Rated Doors: Not less than 3 hinges per door leaf for doors 86 inches (2150 mm) or less in height with same rule for additional hinges.

2.4 LOCK CYLINDERS AND KEYING

A. Standard System: Except as otherwise indicated, provide new masterkey system for Project.

B. Equip locks with high-security cylinders that comply with performance requirements for Grade 1 cylinders as listed in ANSI/BHMA A156.5 and that have been tested for pick and drill resistance requirements of UL 437 and are UL listed.

C. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.

D. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.

1. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."

E. Key Material: Provide keys of nickel silver only.

F. Key Quantity: Furnish 3 change keys for each lock, 5 master keys for each master system, and 5 grandmaster keys for each grandmaster system.

1. Deliver keys to Owner.

2.5 LOCKS, LATCHES, AND BOLTS

A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.

1. Provide flat lip strikes for locks with 3-piece, antifriction latchbolts as recommended by manufacturer.
2. Provide extra long strike lips for locks used on frames with applied wood casing trim.

3. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.
 4. Provide dust-proof strikes for foot bolts, except where special threshold construction provides nonrecessed strike for bolt.
 5. Provide roller type strikes where recommended by manufacturer of the latch and lock units.
 6. Provide standard (open) strike plates for interior doors of residential units where wood door frames are used.
- B. Lock Throw: Provide 5/8-inch (16-mm) minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
1. Provide 1/2-inch (13-mm) minimum throw of latch for other bored and preassembled types of locks and 3/4-inch (19-mm) minimum throw of latch for mortise locks. Provide 1-inch (25-mm) minimum throw for all dead bolts.
- C. Flush Bolt Heads: Minimum of 1/2-inch- (13-mm-) diameter rods of brass, bronze, or stainless steel with minimum 12-inch- (300-mm-) long rod for doors up to 84 inches (2100 mm) in height. Provide longer rods as necessary for doors exceeding 84 inches (2100 mm) in height.
- D. Exit Device Dogging: Except on fire-rated doors where closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to keep the latch bolt retracted, when engaged.
- E. Rabbeted Doors: Where rabbeted door stiles are indicated, provide special rabbeted front on lock and latch units and bolts.

2.6 CLOSERS AND DOOR CONTROL DEVICES

- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.
1. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
 2. Provide parallel arms for all overhead closers, except as otherwise indicated.
- B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.
- C. Combination Door Closers and Holders: Provide units designed to hold door in open position under normal usage and to release and close door automatically under fire conditions. Incorporate an integral electromagnetic holder mechanism designed for use with UL listed fire detectors, provided with normally closed switching contacts.
1. Provide integral smoke detector device in combination door closers and holders complying with UL 228.

2.7 WEATHERSTRIPPING AND SEALS

- A. General: Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

- B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
- C. Weatherstripping at Jambs and Heads: Provide bumper-type resilient insert and metal retainer strips, surface applied unless shown as mortised or semimortised, and of following metal, finish, and resilient bumper material:
1. Extruded aluminum with natural anodized finish, 0.062-inch (1.6-mm) minimum thickness of main walls and flanges.
 2. Sponge neoprene conforming to MIL R 6130, Class II (Closed Cell).
 - a. Grade A: 30 to 150 deg F (-1 to 65 deg C), oil-resistant and self-extinguishing.
 3. Expanded neoprene: Cellular rubber conforming to ASTM D 1056 Type 2 (closed-cell); Class B (low-swell, oil-resistant); Grade 2 (compression-deflection of 5 - 9 psi (35 - 60 kPa)); and self-extinguishing in following size:
 - a. 3/16 x 5/8 inch (5 x 16 mm).
 4. Solid neoprene conforming to MIL R 6855, Class II, Grade 40.
 - a. Flexible, hollow bulb or loop insert.
 5. Flexible vinyl hollow bulb or loop insert.
 6. Brush pile insert of polypropylene or nylon woven pile and aluminum strip backing complying with AAMA 701.2.
- D. Weatherstripping at Door Bottoms: Provide threshold consisting of contact-type resilient insert and metal housing of design and size shown and of following metal, finish, and resilient seal strip:
1. Extruded aluminum with natural anodized finish, 0.062-inch (1.6-mm) minimum thickness of main walls and flanges.
 2. Extruded aluminum with color anodized finish as selected from manufacturer's standard color range, 0.062-inch (1.6-mm) minimum thickness of main walls and flanges.
 3. Extruded bronze (brass) finished to match doors, 0.050-inch (1.3-mm) minimum thickness of main walls and flanges.
 4. Solid neoprene wiper or sweep seal complying with MIL R 6855, Class II, Grade 40.
 5. Flexible vinyl wiper or sweep seal strip.
 6. Brush pile insert of polypropylene or nylon woven pile and aluminum strip backing complying with AAMA 701.2.

2.8 THRESHOLDS

- A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.
- B. Exterior Hinged or Pivoted Doors: Provide units not less than 4 inches (100 mm) wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as follows:
1. For out-swinging doors provide units with interlocking lip and with hook on bottom edge of door to act as weather bar.

2.9 HARDWARE FINISHES

- A. Project Standard; Provide Chrome finish US26 at all exposed finish hardware components.
- A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).
- B. Provide finishes that match those established by BHMA or, if none established, match the Architect's sample.
- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."
- E. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
 - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
 - 2. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."
- F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
 - 1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean 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.
- B. Clean adjacent surfaces soiled by hardware installation.

END OF SECTION 08710

SECTION 08800 - GLAZING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Storefront construction. (section)
 - 2. Curtain wall construction. (section)
 - 3. Signage lettering.

1.3 DEFINITIONS

- A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.
- B. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.
- B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
 - 1. Minimum glass thickness, nominally, of lites in exterior walls is 6 mm.
 - 2. Tinted and heat-absorbing glass thicknesses for each tint indicated are the same throughout Project.
 - 3. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
 - a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass

according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.

- C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change (Range): 120 F deg (67 C deg), ambient; 180 F deg (100 C deg), material surfaces.

1.5 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each glass product and glazing material indicated.
- C. Samples for verification purposes of 12-inch (300 mm) square samples of each type of glass indicated except for clear monolithic glass products, and 12-inch (300 mm) long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.
- D. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.
 - 1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.
- E. Maintenance data for glass and other glazing materials to include in Operating and Maintenance Manual specified in Division 1.

1.6 QUALITY ASSURANCE

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. FGMA Publications: "FGMA Glazing Manual."
 - 2. SIGMA Publications: TM-3000 "Vertical Glazing Guidelines" and TB-3001 "Sloped Glazing Guidelines."
- B. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.
 - 1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

- C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
1. Insulating Glass Certification Council (IGCC).
 2. Associated Laboratories, Inc. (ALI).
 3. National Certified Testing Laboratories (NCTL).
- D. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
1. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include;
1. Guardian SunGuard, Advanced Architectural Glass.
 - a). Product: Superneutral Series SNX 51/23, 1" IG-1/4" clear temp Guardian, ow e #2 surface, 1/2" Argon, 1/4" clear temp.
 - b). COG: .24 U-Factor
 - c). SHGC: .23 SHGC
 - d). VT: .51 VLT
 - e). Outboard – Inboard Substrate: Clear – Clear.
 - f). Appearance: Light Blue.
 - g). Transmittance:
 - 1). Visible Light %; 51
 - 2). Ultra-violet %; 11
 - 3). Solr Energy%; 19
 - h). Reflectance:

- 1). Visible Light Out %; 14
 - 2). Visible Light In %; 14
 - 3). Solar Energy Out %; 36
- i). U-Value Winter Nighttime;
- 1). Air: 0.29
 - 2). Argon: 0.24
- j). Relative Heat Gain: 57
- k). Solar Heat Gain: 0.23
- l). Light to Solar Gain (LSG): 2.19

2.4 INSULATING GLASS PRODUCTS

- A. Sealed Insulating Glass Units: Preassembled units consisting of organically sealed lites of glass separated by dehydrated air spaces complying with ASTM E 774 and with other requirements indicated, including those in Insulating Glass Product Data Sheet at the end of this Section.
1. For properties of individual glass lites making up units, refer to requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products comprising lites of insulating glass units.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 2. Presence and functioning of weep system.
 3. Minimum required face or edge clearances.
 4. Effective sealing between joints of glass-framing members.

- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass from edge damage during handling and installation as follows:
 - 1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
 - 2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass sizes larger than 50 united inches (1250 mm) (length plus height) as follows:
 - 1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
 - 2. Provide 1/8-inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- C. Install gaskets so they protrude past face of glazing stops.

3.5 PROTECTION AND CLEANING

- A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.
- E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 08800

SECTION 08920 - GLAZED ALUMINUM CURTAIN WALLS**PART 1 - GENERAL****1.1 WORK INCLUDED**

- A. Furnish and install architectural aluminum curtain wall complete with related components as shown on drawings and specified in this section.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Building Insulation" for insulation materials and firesafing field installed in conjunction with glazed aluminum curtain wall system.
 - 2. Division 7 Section "Joint Sealants" for joint sealants installed as part of glazed aluminum curtain wall system.
 - 3. Division 8 Section "Aluminum Entrances and Storefronts."
 - 4. Division 8 Section "Glazing."
 - 5. Division 10 Section "Louvers and Vents."

1.2 LABORATORY TESTING AND PERFORMANCE REQUIREMENTS**A. Test Units**

- 1. Air, water, and structural test unit size shall be a minimum of two stories high and three lites wide.
- 2. Thermal test unit sizes shall be 80" (2032 mm) wide x 80" (2032 mm) high with one intermediate vertical mullion and two lites of glass.

B. Test Procedures and Performance

- 1. Air Infiltration Test.
 - a. Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (300 Pa).
 - b. Air infiltration shall not exceed .06 cfm/SF (.31 l/s•m²) of unit.
- 2. Water Resistance Test.
 - a. Test unit in accordance with ASTM E 331.
 - b. The test for static water penetration (ASTM E 331) shall be conducted at an air pressure difference of 15.0 psf (720 Pa). There shall be no water leakage as defined by AAMA 501.1, paragraph 5.5.
- 3. Uniform Load Deflection Test.
 - a. Test in accordance with ASTM E 330.
 - b. Deflection under design load shall not exceed L/175 for spans less than 162" (4114 mm).
 - c. Deflection under design load shall not exceed L/240 +1/4" (6 mm) for spans greater than 162" (4114 mm).
- 4. Uniform Load Structural Test.

- a. Test in accordance with ASTM E 330 at a pressure 1.5 times the design wind pressure in 1.05.B.3.b.
 - b. At conclusion of the test there shall be no glass breakage, permanent damage to fasteners, curtain wall parts, or any other damage that would cause the curtain wall to be defective.
5. Seismic Performance.
- a. Test unit in accordance to AAMA 501.4 system to meet design displacement of 0.010 x the greater adjacent story height and ultimate displacement of 1.5 x the design displacement.
6. Sound Transmission Loss.
- a. Test unit in accordance with ASTM E 90-02.
 - b. Sound Transmission Class (STC) shall not be less than 29.
- C. Wind Loads: Provide glazed aluminum curtain wall system, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.

1.3 QUALITY ASSURANCE

- A. Provide test reports from AAMA accredited laboratories certifying the performance as specified in 1.05.
- B. Test reports shall be accompanied by the curtain wall manufacturer's letter of certification stating that the tested curtain wall meets or exceeds the referenced criteria for the appropriate curtain wall type.

1.4 SUBMITTALS

- A. Contractor shall submit shop drawings; finish samples, test reports, and warranties.
 1. Samples of materials as may be requested without cost to owner, i.e., metal, glass, fasteners, anchors, frame sections, mullion section, corner section, etc.

1.5 WARRANTIES

- A. Total Curtain Wall Installation.
 1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total curtain wall installation. This includes the glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc. as it relates to air, water, and structural adequacy and the specifications and approved shop drawings.
 2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at their expense during the warranty period.

- C. Glass.

1. Provide written warranty for insulated glass units, that they will be free from obstruction of vision as a result of dust or film formation on the internal glass surfaces caused by failure of the hermetic seal due to defects in material and workmanship.
2. Warranty period shall be for 10 (ten) years.
3. Warranty period shall be for 10 years from the date of final shipment.
4. Provide organic finish warranty based on AAMA standard 2605.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Curtain Wall System shall be EFCO Series 5600 Outside Glazed. Other manufacturers requesting approval to bid their product as an equal must submit the following information fifteen days prior to close of bidding.
 - a). A proposal drawing showing full size details of all curtain wall components including all anchors and building attachments.
 - b). Test reports.

2.2 MATERIALS

- A. Aluminum.
1. Extruded aluminum shall be 6063-T6 alloy and temper.
- B. Anchors.
1. Perimeter and floor line anchors shall be aluminum or steel. All steel anchors shall be properly insulated from the aluminum.
- D. Thermal Barrier.
1. The thermal barrier shall be extruded PVC used as an applied thermal isolator.

2.3 FABRICATION

- A. General.
1. All aluminum vertical and horizontal extrusions shall have a minimum wall thickness of .093" (2.3 mm) to .125" (3 mm).
- B. Frame.
1. Frame components shall be mechanically fastened by means of extruded aluminum shear blocks attached to vertical mullions.
 2. Curtain wall system is able to accommodate separate interior and exterior finishes and colors.
- C. Glazing.

1. Outside glazed curtain wall system shall be dry glazed with an exterior aluminum pressure plate and snap cover with interior and exterior dense EPDM preset gaskets.

D. Finish

1. Organic
 - a. Finish all exposed areas of aluminum windows and components with High performance 70% PVDF fluoropolymer Ultrapon.

PART 3 EXECUTION

3.1 INSPECTION

A. Job Conditions.

1. All openings shall be prepared by others to the proper size and shall be plumb, level, and in the proper location and alignment as shown on the architect's drawings.

3.2 INSTALLATION

- A. Use only skilled tradesmen with work done in accordance with approved shop drawings and established specifications, and erect all curtain wall components to all building bench marks and column center lines.
- B. Plumb and align curtain wall faces in a single plane for each wall plane, and erect curtain wall materials square and true. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, building movement, and specified wind loads.
- C. Adjust windows in curtain wall for proper operation after installation.
- D. Furnish and apply sealants to provide a weather tight installation at all joints and intersections and at opening perimeters. Wipe off excess material, leave all exposed surfaces and joints clean and smooth.

3.3 ANCHORAGE

- A. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads.

3.4 PROTECTION AND CLEANING

- A. The general contractor shall protect the aluminum materials and finish against damage from construction activities and harmful substances. The general contractor shall remove any protective coatings as directed by the architect, and shall clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION 08920

SECTION 09220 - PORTLAND CEMENT PLASTER**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Metal lath and accessories.
 - 2. Portland cement plaster.
 - 3. Stucco finishes.

1.3 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 product specified.
- C. Material Certificates: Submit certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cementitious materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.
- B. Store materials inside, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements, General: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.
- B. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

PART 2 - PRODUCTS

2.1 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. Expanded-Metal Lath:
 - a. Alabama Metal Industries Corp. (AMICO).
 - b. California Expanded Metal Products Co.
 - c. Dale//Incor Industries, Inc.
 - d. Dietrich Industries, Inc.
 - e. National Gypsum Co.
 - f. Unimast, Inc.
 - g. United States Gypsum Co.
 - h. Western Metal Lath Co.
 2. Metal Accessories:
 - . Dale//Incor Industries, Inc.
 - f. Fry Reglet Corporation.
 - j. National Gypsum Co.
 - n. United States Gypsum Co.
 - o. Western Metal Lath Co.
 3. Stucco:
 - a. California Stucco Products Corp.
 - b. LaHabra Stucco.
 - c. United States Gypsum Co.
 - d. Omega Products International.

2.2 LATH

- A. Expanded-Metal Lath: Comply with ASTM C 847 for material, type, configuration, and other characteristics indicated below.
1. Material: Fabricate expanded-metal lath from sheet metal conforming to the following:
 - a. Galvanized Steel: Structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) minimum coating designation, unless otherwise indicated.
 2. Diamond-Mesh Lath: Comply with the following requirements:
 - a. Configuration: Self-furring.
 - 1) Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m).

2.3 ACCESSORIES

- A. General: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required.

1. Aluminum Components: Alloy, temper, and finish recommended by manufacturer with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for alloy and temper 6063-T5.
 2. Galvanized Steel Components: Fabricated from zinc-coated (galvanized) steel sheet complying with ASTM A 653, G40 (ASTM A 653M, Z90) minimum coating designation.
 3. Zinc-Alloy Components: ASTM B 69, 99 percent pure zinc.
- B. Metal Corner Reinforcement: Expanded, large-mesh, diamond-metal lath fabricated from zinc-alloy or welded-wire mesh fabricated from 0.0475-inch- (1.2-mm-) diameter, zinc-coated (galvanized) wire and specially formed to reinforce external corners of portland cement plaster on exterior exposures while allowing full plaster encasement.
- C. Cornerbeads: Small nose cornerbeads fabricated from the following metal, with expanded flanges of large-mesh diamond-metal lath allowing full plaster encasement.
1. Zinc Alloy: Minimum 0.0207 inch (0.53 mm) thick.
 2. Galvanized Steel: Minimum 0.0172 inch (0.44 mm) thick.
 3. Aluminum: Minimum 0.050 inch (1.2 mm) thick.
 4. Material: Any material above.
- D. Casing Beads: Square-edged style, with expanded flanges of the following material:
1. Zinc Alloy: Minimum 0.0207 inch (0.53 mm) thick.
 2. Galvanized Steel: Minimum 0.0172 inch (0.44 mm) thick.
 3. Aluminum: Minimum 0.050 inch (1.2 mm) thick.
 4. Material: Any material above.
- E. Control Joints: Prefabricated, of material and type indicated below:
1. Zinc Alloy: Minimum 0.0207 inch (0.53 mm) thick.
 2. Galvanized Steel: Minimum 0.0172 inch (0.44 mm) thick.
 3. Aluminum: Minimum 0.050 inch (1.2 mm) thick.
 4. Material: Any material above.
 5. Two-Piece Type: Pair of casing beads with back flanges formed to provide slip-joint action, adjustable for joint widths from 1/8 to 5/8 inch (3 to 16 mm).
 - a. Provide removable protective tape on plaster face of control joints.
- F. Foundation Sill (Weep) Screed: Manufacturer's standard profile designed for use at sill plate line to form plaster stop and prevent plaster from contacting damp earth, fabricated from zinc-coated (galvanized) steel sheet.
- G. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.

2.4 PLASTER MATERIALS

- A. Base-Coat Cements: Type as indicated below:
1. Portland cement, ASTM C 150, Type I.
- B. Job-Mixed Finish-Coat Cement: Material and color as indicated below:
1. Portland cement, ASTM C 150, Type I.
 2. Portland cement, ASTM C 150, Type II.
- C. Cement Color: White.

1. Provide color selected by Architect from manufacturer's full range of colors.
- D. Stucco Finish Coat: Manufacturer's standard factory-packaged stucco, including portland cement, aggregate, coloring agent, and other proprietary ingredients.
- E. Factory-Prepared Finish Coat: Manufacturer's standard factory-packaged blend of portland cement, ASTM C 150, Type I or III; hydrated lime, Type S, ASTM C 206 or ASTM C 207; aggregate, ASTM C 897; and compatible with base coat and finish texture indicated; in color indicated below:
1. Color as indicated, manufacturer's standard product consisting of white or gray cement combined with colorfast mineral pigments and aggregates selected for color.
 2. Provide color selected by Architect from manufacturer's full range of colors.
- F. Lime: Special hydrated lime for finishing purposes, ASTM C 206, Type S; or special hydrated lime for masonry purposes, ASTM C 207, Type S.
- G. Sand Aggregate for Base Coats: ASTM C 897.
- H. Aggregate for Finish Coats: ASTM C 897 system and as indicated below:
1. Manufactured or natural sand, in color matching Architect's sample.

2.5 MISCELLANEOUS MATERIALS

- A. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.
- B. Water for Mixing and Finishing Plaster: Potable.
- C. Bonding Agent: ASTM C 932.

2.6 PLASTER MIXES AND COMPOSITIONS

- A. General: Comply with ASTM C 926 for base- and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated.
- B. Base-Coat Mixes and Compositions: Proportion materials for respective base coats in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.
- C. Fiber Content: Add fiber to following mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's written instructions but do not exceed 1 lb/cu. ft. (16 kg/cu. m) of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.
- D. Three-Coat Work over Metal Lath: Base-coat proportions as indicated below:
1. Scratch Coat: 1 part portland cement, 0 to 3/4 parts lime, 2-1/2 to 4 parts aggregate.
 2. Brown Coat: 1 part portland cement, 0 to 3/4 parts lime, 3 to 5 parts aggregate.
- E. Two-Coat Work over Concrete Unit Masonry: Base-coat proportions as indicated below:

1. Base Coat: 1 part portland cement, 3/4 to 1-1/2 parts lime, 3 to 4 parts aggregate.
- F. Job-Mixed Finish Coats: Proportion materials for finish coats in parts by volume for cementitious materials and parts by volume per sum of cementitious materials to comply with the following requirements:
 1. Proportions using sand aggregates as indicated below:
 - a. 1 part portland cement, 3/4 to 1-1/2 parts lime, 3 parts sand.
- G. Factory-Prepared Finish Coats: Add water only; comply with finish coat manufacturer's written instructions.
- H. Stucco Finish Coat: Add water only; comply with stucco manufacturer's written instructions.

2.7 MIXING

- A. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF LATH AND FURRING, GENERAL

- A. Standards: Comply with ML/SFA 920, "Guide Specifications for Metal Lathing and Furring," and with requirements of ASTM C 1063.
- B. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, handrails, furnishings, and similar work to comply with details indicated or, if not otherwise indicated, to comply with applicable written instructions of lath and furring manufacturer.
- C. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition or wall abuts overhead structure, sufficiently isolate from structural movement to prevent transfer of loading from building structure. Install slip- or cushion-type joints to absorb deflections but maintain lateral support.
 1. Frame both sides of control joints independently and do not bridge joints with furring and lathing or accessories.
- D. Install additional framing, furring, runners, lath, and beads, as required to form openings and frames for other work as indicated. Coordinate support system for proper support of framed work that is not indicated to be supported independently of metal furring and lathing system.

3.2 LATHING

- A. Install metal lath for the following applications where plaster base coats are required. Provide appropriate type, configuration, and weight of metal lath selected from materials indicated that comply with referenced ML/SFA specifications and ASTM lathing installation standards.
 1. Suspended and furred ceilings using 3.4-lb/sq. yd. (1.8-kg/sq. m) minimum weight, diamond-mesh lath.

2. Vertical metal framing and furring using 3.4-lb/sq. yd. (1.8-kg/sq. m) minimum weight, diamond-mesh lath and cold-rolled channel stud framing.
3. Ceramic-tile setting beds using 3.4-lb/sq. yd. (1.8-kg/sq. m) minimum weight, diamond-mesh lath.
4. Exterior sheathed wall surfaces using 3.4-lb/sq. yd. (1.8-kg/sq. m) minimum weight, self-furring, diamond-mesh lath.

3.3 PREPARATIONS FOR PLASTERING

- A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair the Work.
- B. Install temporary grounds and screeds to ensure accurate rodding of plaster to true surfaces; coordinate with scratch-coat work.
- C. Surface Conditioning: Immediately before plastering, dampen concrete and concrete unit masonry surfaces that are indicated for direct plaster application, except where a bonding agent has been applied. Determine and apply amount of moisture and degree of saturation that will result in optimum suction for plastering.

3.4 INSTALLATION OF PLASTERING ACCESSORIES

- A. General: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering. Install accessories of type indicated at following locations:
 1. External Corners: Install corner reinforcement at external corners.
 2. Terminations of Plaster: Install casing beads, unless otherwise indicated.
 3. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Architect:
 - a. Where an expansion or contraction joint occurs in surface of construction directly behind plaster membrane.
 - b. Distance between Control Joints: Not to exceed 18 feet (5.4 m) in either direction or a length-to-width ratio of 2-1/2 to 1.
 - c. Wall Areas: Not more than 144 sq. ft. (13 sq. m).
 - d. Horizontal Surfaces: Not more than 100 sq. ft. (9 sq. m) in area.
 - e. Where plaster panel sizes or dimensions change, extend joints full width or height of plaster membrane.

3.5 PLASTER APPLICATION

- A. Plaster Application Standard: Apply plaster materials, composition, and mixes to comply with ASTM C 926.
- B. Do not use materials that are frozen, caked, lumpy, dirty, or contaminated by foreign materials.
- C. Do not use excessive water in mixing and applying plaster materials.

- D. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet (3 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed at any location on surface.
- E. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, and before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches (152 mm) at each jamb anchor.
- F. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.
- G. Plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where interior plaster is not terminated at metal frame by casing beads, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
- H. Corners: Make internal corners and angles square; finish external corners flush with cornerbeads on interior work, square and true with plaster faces on exterior work.
- I. Number of Coats: Apply plaster of composition indicated, to comply with the following requirements:
 - 1. Three Coats: Over the following plaster base:
 - a. Metal lath.
 - 2. Two Coats: Over the following plaster bases:
 - a. Concrete unit masonry.
- J. Finish Coats: Apply finish coats to comply with the following requirements:
 - 1. Float Finish: Apply finish coat to a minimum thickness of 1/8 inch (3 mm) to completely cover base coat, uniformly floated to a true even plane with fine-textured finish matching Architect's sample.
 - 2. Color / Locations; As selected by owner and indicated on drawings.

3.6 CUTTING AND PATCHING

- A. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.7 CLEANING AND PROTECTING

- A. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09220

SECTION 09255 - GYPSUM BOARD ASSEMBLIES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Nonload-bearing steel framing members for gypsum board assemblies.
 - 2. Gypsum board assemblies attached to steel framing.
 - 3. Gypsum board assemblies attached to wood framing.
 - 4. Cementitious backer units installed with gypsum board assemblies.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 9 Section "Tile" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 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 product specified.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.
- B. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- D. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:

1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
3. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.
- B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.
- C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 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. Steel Framing and Furring:
 - a. Clark Steel Framing, Inc.
 - b. Consolidated Systems, Inc.
 - c. Dale Industries, Inc.
 - d. Dietrich Industries, Inc.
 - e. Marino/Ware (formerly Marino Industries Corp.).
 - f. National Gypsum Co.; Gold Bond Building Products Division.
 - g. Unimast, Inc.
 2. Grid Suspension Assemblies:

- a. Armstrong World Industries, Inc.
 - b. Chicago Metallic Corp.
 - c. USG Interiors, Inc.
 - d. Worthington Steel Company (formerly National Rolling Mills).
3. Gypsum Board and Related Products:
- a. Domtar Gypsum.
 - b. Georgia-Pacific Corp.
 - c. National Gypsum Co.; Gold Bond Building Products Division.
 - d. United States Gypsum Co.
 - e. Pabco Gypsum.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work where proprietary gypsum wallboard is indicated include, but are not limited to, the following:
1. Gyrock Fireguard C Gypsum Board; Domtar Gypsum.
 2. Firestop Type C; Georgia-Pacific Corp.
 3. Fire-Shield G; National Gypsum Co.; Gold Bond Building Products Division.
 4. SHEETROCK Brand Gypsum Panels, FIRECODE C Core; United States Gypsum Co.
 5. SHEETROCK Brand Gypsum Panels, ULTRACODE Core; United States Gypsum Co.

2.2 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

- A. General: Provide components complying with ASTM C 754 for conditions indicated.
- B. Wire Ties: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.062 inch (1.6 mm) thick.
- C. Wire Hangers: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.162-inch (4.1-mm) diameter.
- D. Hanger Rods: Mild steel and zinc coated or protected with rust-inhibitive paint.
- E. Flat Hangers: Mild steel and zinc coated or protected with rust-inhibitive paint.
- F. Angle-Type Hangers: Angles with legs not less than 7/8 inch (22.2 mm) wide, formed from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet complying with ASTM A 653, G 90 (ASTM A 653M, Z 180) coating designation, with bolted connections and 5/16-inch (8-mm) diameter bolts.
- G. Channels: Cold-rolled steel, 0.0598-inch (1.5-mm) minimum thickness of base (uncoated) metal and 7/16-inch- (11.1-mm-) wide flanges, and as follows:
1. Carrying Channels: 2 inches (50.8 mm) deep, 590 lb/1000 feet (88 kg/100 m), unless otherwise indicated.
 2. Furring Channels: 3/4 inch (19.1 mm) deep, 300 lb/1000 feet (45 kg/100 m), unless otherwise indicated.
 3. Finish: Rust-inhibitive paint, unless otherwise indicated.
- H. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross-furring members that interlock to form a modular supporting network.

2.3 STEEL FRAMING FOR WALLS AND PARTITIONS

- A. General: Provide steel framing members complying with the following requirements:
1. Protective Coating: Manufacturer's standard corrosion-resistant coating.
 2. Protective Coating: ASTM A 653, G 40 (ASTM A 653M, Z 90) hot-dip galvanized coating for framing members attached to and within 10 feet (3 m) of exterior walls.
- B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch- (5-mm-) wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
1. Thickness: 0.0179 inch (0.45 mm), unless otherwise indicated.
 - a. For head runner, sill runner, jamb, and cripple studs at door and other openings.
 - b. In locations to receive cementitious backer units.
 - c. Where indicated.
 2. Thickness: As indicated.
 3. Depth: 3-5/8 inches (92.1 mm), unless otherwise indicated.
 4. Depth: 6 inches (152.4 mm) where indicated.
- C. Deflection Track: Manufacturer's standard top runner designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653 (ASTM A 653M) or ASTM A 568 (ASTM A 568M). Thickness as indicated for studs, and width to accommodate depth of studs, and of the following configuration:
1. Top Runner with Compressible Flanges: 2-1/2-inch- (63.5-mm-) deep flanges with V-shaped offsets that compress when pressure is applied from construction above.
 2. Top Runner with Slotted Flanges: 2-1/2-inch- (63.5-mm-) deep flanges with slots 1 inch (25.4 mm) o.c.
 3. Top runner with 2-1/2-inch- (63.5-mm-) deep flanges that either have V-shaped offsets that compress when pressure is applied from construction above or have slots 1 inch (25.4 mm) o.c. that allow fasteners attached to studs through the slots to accommodate structural movement by slipping.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1) Superior Flex Track System (SFT); Delta Star, Inc.
 - 2) SLP-TRK; Metal-Lite, Inc.
- D. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.4 GYPSUM BOARD PRODUCTS

- A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.

1. Widths: Provide gypsum board in widths of 48 inches (1219 mm).
- B. Gypsum Wallboard: ASTM C 36 and as follows:
1. Type: Regular for vertical surfaces, unless otherwise indicated.
 2. Type: Type X where required for fire-resistance-rated assemblies.
 3. Edges: Tapered and featured (rounded or beveled) for prefilling.
 4. Thickness: 5/8 inch (15.9 mm) where indicated.
- C. Water-Resistant Gypsum Backing Board: ASTM C 630 and as follows:
1. Type: Regular, unless otherwise indicated.
 2. Type: Type X where required for fire-resistance-rated assemblies and where indicated.
 3. Thickness: 5/8 inch (15.9 mm), unless otherwise indicated.
 4. Locations: At all restrooms and back splash wall unless noted otherwise.

2.5 CEMENTITIOUS BACKER UNITS

- A. Provide cementitious backer units complying with ANSI A118.9, of thickness and width indicated below, and in maximum lengths available to minimize end-to-end butt joints.
1. Thickness: 5/8 inch (15.9 mm), where indicated.
 2. Width: Manufacturer's standard width, but not less than 32 inches (813 mm).
- B. Available Products: Subject to compliance with requirements, cementitious backer units that may be incorporated in the Work include, but are not limited to, the following:
1. The Original Wonderboard; Custom Building Products.
 2. Wonderboard Multi+Board; Custom Building Products.
 3. DomCrete Cementitious Tile-Backer Board; Domtar Gypsum.
 4. Util-A-Crete Concrete Backer Board; FinPan, Inc.
 5. DUROCK Cement Board; United States Gypsum Co.

2.6 TRIM ACCESSORIES

- A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
1. Material: Formed metal or plastic, with metal complying with the following requirement:
 - a. Steel sheet zinc coated by hot-dip process or rolled zinc.
 2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
 - a. Cornerbead on outside corners, unless otherwise indicated.
 - b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
 - c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
 - d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
 - e. One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

- A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.
- C. Joint Tape for Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.
- D. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
 - 1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
 - 2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
 - 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
 - 4. For topping compound, use sandable formulation.
- E. Joint Compound for Cementitious Backer Units: Material recommended by cementitious backer unit manufacturer.

2.8 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
- B. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot-grouting hollow metal door frames.
- C. Fastening Adhesive for Wood: ASTM C 557.
- D. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.
- E. Steel drill screws complying with ASTM C 1002 for the following applications:
 - 1. Fastening gypsum board to wood members.
 - 2. Fastening gypsum board to gypsum board.
- F. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
- G. Steel drill screws of size and type recommended by unit manufacturer for fastening cementitious backer units.
- H. Gypsum Board Nails: ASTM C 514.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction.
- B. Before sprayed-on fireproofing is applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fireproofing. Where offset anchor plates are required, provide continuous units fastened to building structure not more than 24 inches (600 mm) o.c.
- C. After sprayed-on fireproofing has been applied, remove only as much fireproofing as needed to complete installation of gypsum board assemblies without reducing thickness of fireproofing below that is required to obtain fire-resistance rating indicated. Protect remaining fireproofing from damage.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
 - 1. Where building structure abuts ceiling perimeter or penetrates ceiling.
 - 2. Where partition framing and wall furring abut structure, except at floor.
 - a. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.
 - b. Install deflection track top runner to attain lateral support and avoid axial loading.
 - c. Install deflection and firestop track top runner at fire-resistance-rated assemblies where indicated.

- D. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.4 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
 - 1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
- D. Install steel studs and furring in sizes and at spacings indicated.
 - 1. Single-Layer Construction: Space studs 16 inches (406 mm) o.c., unless otherwise indicated.
 - 2. Cementitious Backer Unit Construction: Space studs 16 inches (406 mm) o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.
- F. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1. Install 2 studs at each jamb, unless otherwise indicated.

3.5 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.
- B. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- C. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Avoid joints other than control joints at corners of framed openings where possible.
- D. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- E. Attach gypsum panels to framing provided at openings and cutouts.

- F. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Instead, float gypsum panels over these members using resilient channels or provide control joints to counteract wood shrinkage.
- G. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
- H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.
 - 1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- I. Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- J. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.6 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels as follows:
 - 1. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At stairwells and other high walls, install panels horizontally.
- B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:
 - 1. Install cementitious backer units to comply with ANSI A108.11 at showers, tubs, and where indicated.
 - 2. Install cementitious backer units to comply with ANSI A108.11 at locations indicated to receive wall tile.
 - 3. Install water-resistant gypsum backing board panels at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or penetrations.
 - 4. Install gypsum wallboard panels with tapered edges taped and finished to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
- C. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:

1. Fasten to wood supports with double nailing.

3.7 INSTALLING TRIM ACCESSORIES

- A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.
- B. Install cornerbead at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
 3. Install U-bead where indicated.
 4. Install aluminum trim and other accessories where indicated.
- D. Install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by Architect for visual effect.

3.8 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.
- D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
 1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 2. Level 2 where panels form substrates for tile and where indicated.
 3. Level 4 for gypsum board surfaces, unless otherwise indicated.
- E. Use one of the following joint compound combinations as applicable to the finish levels specified:
 1. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Sandable, setting-type joint compound.
- F. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840 and gypsum board manufacturer's directions for treatment of joints behind tile.

- G. Finish cementitious backer units to comply with unit manufacturer's directions.

3.9 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes according to texture finish manufacturer's instructions. Apply primer only to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish to gypsum panels and other surfaces indicated to receive texture finish according to texture finish manufacturer's directions. Using powered spray equipment, produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray as recommended by texture finish manufacturer to prevent damage.

3.10 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09255

SECTION 09310 - CERAMIC TILE**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Paver tile.
- 2. Glazed wall tile.
- 3. Waterproof membrane for thin-set tile installations.

- B. Related Sections include the following:

- 1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
- 2. Division 9 Section "Portland Cement Plaster" for portland cement scratch coat over metal lath on wall surfaces.
- 3. Division 9 Section "Gypsum Board Assemblies" for cementitious backer units installed in gypsum wallboard assemblies.

1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 SUBMITTALS

- A. Product Data: For each type of tile, mortar, grout, and other products specified.
- B. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.
- C. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
- D. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
 - 1. Each type and composition of tile and for each color and texture required, at least 12 inches (300 mm) square, mounted on braced cementitious backer units, and with grouted

joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.

- E. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.
- F. 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 of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.
- C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 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. Tile Products:

- a. American Marrazzi Tile, Inc.
- b. American Olean Tile Company.
- c. Buchtal Corporation USA.
- d. Cerim-Floor Gres Ceramiche.
- e. Crossville Ceramics.
- f. Dal-Tile Corporation.
- g. Florida Tile Industries, Inc.
- h. GranitiFiandre.
- i. Interceramics, USA.
- j. KPT, Inc.
- k. Laufen International, Inc.
- l. Lonestar Ceramics Company.
- m. Mannington Ceramic Tile.
- n. Metropolitan Ceramics.
- o. Monarch Tile, Inc.
- p. Quarry Tile Company.
- q. Seneca Tiles, Inc.
- r. Summitville Tiles, Inc.
- s. United States Ceramic Tile Company.

2. Tile-Setting and -Grouting Materials:

- a. American Olean Tile Company.
- b. Atlas Minerals & Chemicals, Inc.
- c. Boiardi Products Corporation.
- d. Bonsal: W.R. Bonsal Company.
- e. Bostik.
- f. C-Cure Corporation.
- g. Custom Building Products.
- h. Dal-Tile Corporation.
- i. DAP, Inc.
- j. Laticrete International, Inc.
- k. Mapei Corporation.
- l. Southern Grouts & Mortars, Inc.
- m. Summitville Tiles, Inc.
- n. TEC Incorporated.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
 2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

2.3 TILE PRODUCTS

- A. Unglazed Paver Tile: Provide flat tile complying with the following requirements:
1. Composition: Porcelain.
 2. Facial Dimensions: 7-7/8 by 7-7/8 inches (200 by 200 mm).
 3. Thickness: 3/8 inch (9.5 mm).
 4. Face: Plain with square or cushion edges.
 5. For latex-portland cement mortared and grouted paver tile, precoat with temporary protective coating.
- B. Glazed Paver Tile: Provide flat tile complying with the following requirements:
1. Composition: Porcelain.
 2. Composition: Impervious natural clay.
 3. Composition: Semivitreous natural clay.
 4. Composition: Vitreous natural clay.
 5. Facial Dimensions: 4 by 4 inches (102 by 102 mm).
 6. Facial Dimensions: 7-7/8 by 7-7/8 inches (200 by 200 mm).
 7. Facial Dimensions: 11-13/16 by 11-13/16 inches (300 by 300 mm).
 8. Thickness: 3/8 inch (9.5 mm).
 9. Face: Plain with square or cushion edges.
- C. Glazed Wall Tile: Provide flat tile complying with the following requirements:
1. Module Size: 6 by 6 inches (152 by 152 mm).
 2. Face: Plain with modified square edges or cushion edges.
- D. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
 2. Shapes: As follows, selected from manufacturer's standard shapes:
 - a. Base for Portland Cement Mortar Installations: Coved.
 - b. Base for Thin-Set Mortar Installations: Straight.
 - c. Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap.
 - d. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
 - e. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above.
 - f. External Corners for Portland Cement Mortar Installations: Bullnose shape with a radius of at least 3/4 inch (19 mm), unless otherwise indicated.
 - g. External Corners for Thin-Set Mortar Installations: Surface bullnose.

- h. Internal Corners: Field-buttet square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

2.4 WATERPROOFING FOR THIN-SET TILE INSTALLATIONS

- A. General: Provide products that comply with ANSI A118.10 and the descriptions in this Article.
- B. Polyethylene-Sheet Waterproofing: Manufacturer's standard proprietary product consisting of composite sheets, 60 inches (152 mm) wide by a nominal thickness of 0.030 inches (0.76 mm), composed of an inner layer of nonplasticized, chlorinated polyethylene sheet faced on both sides with laminated, high-strength, nonwoven polyester material, designed for embedding in latex-portland cement mortar and as the substrate for latex-portland cement mortar setting bed.
- C. Latex-Rubber Waterproofing: Manufacturer's standard factory-packaged, job-mixed, proprietary, 2-part formulation consisting of liquid-latex rubber and powder for trowel application and glass-fiber-fabric reinforcing.
- D. Acrylic-Latex Waterproofing: Manufacturer's standard proprietary product consisting of one-part acrylic-latex additive and flexible cementitious fiber mortar, factory packaged for job-mixing and trowel application.
- E. Urethane Waterproofing and Tile-Setting Adhesive: Manufacturer's standard proprietary product consisting of 1-part liquid-applied urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a 2-step process.
- F. Available Products: Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:
 - 1. Polyethylene-Sheet Waterproofing:
 - a. Nobleseal TS; Noble Company (The).
 - 2. Latex-Rubber Waterproofing:
 - a. Trowel & Seal Waterproof Membrane; Custom Building Products.
 - b. Laticrete 9235 Waterproof Membrane; Laticrete International, Inc.
 - c. S-9000; Summitville Tiles, Inc.
 - 3. Acrylic-Latex Waterproofing:
 - a. PRP 315; Mapei Corporation.
 - 4. Urethane Waterproofing and Tile-Setting Adhesive:
 - a. Hydroment Ultra-Set; Bostik.
 - b. Deck-Seal 1000; Southern Grouts & Mortars, Inc.

2.5 SETTING MATERIALS

- A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1A and as specified below:

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15), or polyethylene sheeting ASTM D 4397, 4.0 mils (0.1 mm) thick.
 2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82, except for minimum wire size.
 3. Expanded Metal Lath: Provide diamond-mesh lath complying with ASTM C 847 for requirements indicated below:
 - a. Base Metal and Finish for Interior Applications: Fabricate lath from uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - b. Configuration over Studs and Furring: Flat.
 - c. Configuration over Solid Surfaces: Self-furring.
 - d. Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m).
 4. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.
 - a. Latex Additive: Manufacturer's standard.
- B. Dry-Set Portland Cement Mortar: ANSI A118.1.
1. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.
- C. Latex-Portland Cement Mortar: ANSI A118.4, composed as follows:
1. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
 2. Mixture of Dry-Mortar Mix and Latex Additive: Mixture of prepackaged dry-mortar mix and liquid-latex additive complying with the following requirements:
 - a. Latex Additive: Styrene butadiene rubber.
 - b. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

2.6 GROUTING MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Commercial Portland Cement Grout (Sanded Grout): ANSI A118.6, color as indicated, for joints 1/8 inch (3.2 mm) or wider.
- C. Dry-Set Grout: ANSI A118.6, color as indicated.
- D. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:
 1. Factory-Prepared, Dry-Grout Mixture: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following:

- a. Unsanded grout mixture for joints 1/8 inch (3.2 mm) and narrower.
 - b. Sanded grout mixture for joints 1/8 inch (3.2 mm) and wider.
2. Mixture of Dry-Grout Mix and Latex Additive: Mixture of factory-prepared, dry-grout mix and latex additive complying with the following requirements:
- a. Unsanded Dry-Grout Mix: Dry-set grout complying with ANSI A118.6 for materials described in Section H-2.3, for joints 1/8 inch (3.2 mm) and narrower.
 - b. Sanded Dry-Grout Mix: Commercial portland cement grout complying with ANSI A118.6 for materials described in Section H-2.1, for joints 1/8 inch (3.2 mm) and wider.
 - c. Latex Additive: Styrene butadiene rubber.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

- B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
 - 1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
- H. Grout tile to comply with the requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

3.4 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

- B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.
- B. Joint Widths: Install tile on floors with the following joint widths:
 - 1. Paver Tile: 3/8 inch (9.5 mm).

3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Install metal lath and scratch coat to walls to comply with ANSI A108.1A, Section 4.1.
- C. Joint Widths: Install tile on walls with the following joint widths:
 - 1. Wall Tile: 1/16 inch (1.6 mm).

3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.
 - 1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 - 2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09310

SECTION 09511 - ACOUSTICAL PANEL CEILINGS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.
- B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
- C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with, or supported by the ceilings.
- D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
- E. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
 - 1. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 2. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.
 - 3. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory
- B. Acoustical Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate

the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

- C. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
 - 1. Acoustical Panels: Sagging and warping
 - 2. Grid System: Rusting and manufacturer's defects
- B. Warranty Period:
 - 1. Acoustical panels: One (1) year from date of substantial completion
 - 2. Cirrus: Ten (10) years from date of substantial completion
 - 3. Grid: One (1) year from date of substantial completion
- C. 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 the requirements of the Contract Documents.

1.7 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to;
1. Ceiling Panels: Armstrong World Industries, Inc.
 2. Suspension Systems: Armstrong World Industries, Inc.
 3. Perimeter Systems: Armstrong World Industries, Inc.

2.2 ACOUSTICAL CEILING UNITS

- A. Acoustical Panels Type AP
1. Surface Texture: Medium
 2. Composition: Mineral Fiber
 3. Color: White
 4. Size: 24IN x 48IN
 5. Edge Profile: Square Lay-In 15/16IN for interface with PRELUDE ML 15/16" Exposed Tee grid.
 6. Noise Reduction Coefficient(NRC): ASTM C 423; Classified with UL label on product carton 0.70
 7. Ceiling Attenuation Class (CAC) : ASTM C 1414; Classified with UL label on product carton 35
 8. Sabin:N/A
 9. Articulation Class (AC):
 10. Flame Spread: ASTM E 1264; Class A (UL)
 11. Light Reflectance (LR) White Panel: ASTM E 1477; 0.86
 12. Dimensional Stability: Standard
 13. Recycle Content: Post-Consumer - 0% Pre-Consumer - 67%
 14. Acceptable Product: CIRBUS, 533 as manufactured by Armstrong World Industries

2.3 METAL SUSPENSION SYSTEMS

- A. Components:
1. Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
 - a. Structural Classification: ASTM C 635 Intermediate Duty duty
 - b. Color: Blizzard White and match the actual color of the selected ceiling tile, unless noted otherwise.
 - c. Acceptable Product: PRELUDE ML 15/16" Exposed Tee as manufactured by Armstrong World Industries
- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

- D. Edge Moldings and Trim:
 - 1. 7802 - 10ft Hemmed Angle Molding.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 - 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

- A. Follow manufacturer installation instructions.
- B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.
- C. Suspend main beam from overhead construction with hanger wires spaced 4'-0" on center along the length of the main runner. Install hanger wires plumb and straight.
- D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.
- E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.
- F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.

- B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.
- C. Before disposing of ceilings, contact the Armstrong Recycling Center at 877-276-7876, select option #1 then #8 to review with a consultant the condition and location of building where the ceilings will be removed. The consultant will verify the condition of the material and that it meets the Armstrong requirements for recycling. The Armstrong consultant will provide assistance to facilitate the recycle of the ceiling.

END OF SECTION 09511

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Resilient wall base.
 - 2. Resilient flooring accessories.
 - 3. Resilient carpet accessories.
- B. Related Sections include the following:
 - 1. Division 9 Section "Sheet Vinyl Floor Coverings."

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.
- C. Samples for Verification: In manufacturer's standard sizes, but not less than 12 inches (300 mm) long, of each product color and pattern specified.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F (10 and 32 deg C).

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- B. Do not install products until they are at the same temperature as the space where they are to be installed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet (3 linear m) for each 500 linear feet (150 linear m) or fraction thereof, of each different type, color, pattern, and size of resilient product installed.
 - 2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering handrails and railing systems that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Resilient wall base and accessories:
 - a. Afco Rubber Corp.
 - b. American Biltrite (Canada) Ltd. Estrie Products International
 - c. Armstrong World Industries, Inc.
 - d. Burke Industries, Burke Flooring Products
 - e. Duramax, Inc. Johnsonite
 - f. Domco Industries, Ltd. Azrock Industries Inc.
 - g. Domco Industries, Ltd. National Floor Products Co., Inc. (NAFCO)
 - h. Endura
 - i. Freudenberg Building Systems, Inc. Nora Rubber Flooring
 - j. Jason Industrial Inc.
 - k. Macklanburg-Duncan Co.
 - l. Mannington, Inc. Mannington Commercial
 - m. Mercer Products Co., Inc.
 - n. Mondo America, Inc.
 - o. PRF USA, Inc. Pirelli Rubber Flooring
 - p. R.C.A. Rubber Co. (The)
 - q. R.C. Musson Rubber Co.
 - r. Robbins, Inc. Flexco

2.2 RESILIENT WALL BASE

- A. Rubber Wall Base: Products complying with FS SS-W-40, Type I and with requirements specified in the Resilient Wall Base and Accessory Schedule.

2.3 RESILIENT ACCESSORIES

- A. Rubber Accessories: Products complying with requirements specified in the Resilient Wall Base and Accessory Schedule.

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Install resilient products according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 3. Do not stretch base during installation.
 4. Install premolded outside corners before installing straight pieces.
 5. Install premolded outside and inside corners before installing straight pieces.
 6. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 7. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
- C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.
- D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 2. Sweep or vacuum horizontal surfaces thoroughly.
 3. Do not wash resilient products until after time period recommended by resilient product manufacturer.
 4. Damp-mop or sponge resilient products to remove marks and soil.
- B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.
1. Apply protective floor polish to vinyl resilient products installed on floors and stairs that are free from soil, visible adhesive, and surface blemishes, if recommended by manufacturer.
 - a. Use commercially available product acceptable to resilient product manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
 2. Cover resilient products installed on floors and stairs with undyed, untreated building paper until inspection for Substantial Completion.
- C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.
1. Before cleaning, strip protective floor polish that was applied to vinyl products on floors and stairs after completing installation only if required to restore polish finish and if recommended by resilient product manufacturer.
 2. After cleaning, reapply polish on vinyl products on floors and stairs to restore protective floor finish according to resilient product manufacturer's written recommendations. Coordinate with Owner's maintenance program.

END OF SECTION 09653

SECTION 09690 - CARPET TILE**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes carpet tile and installation.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 6 Section "Rough Carpentry" for subflooring and underlayment.
 - 2. Division 9 Section "Resilient Wall Base and Accessories" for materials and installation.

1.3 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 carpet tile material and installation accessory specified. Submit manufacturer's printed data on physical characteristics, durability, fade resistance, and fire-test-response characteristics. Submit methods of installation for each type of substrate.
- C. Shop Drawings showing columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tile. Indicate the following:
 - 1. Existing flooring materials to be removed.
 - 2. Existing flooring materials to remain.
 - 3. Carpet tile type, color, and dye lot.
 - 4. Locations where dye lot changes occur.
 - 5. Seam locations, types, and methods.
 - 6. Type of subfloor.
 - 7. Type of installation.
 - 8. Pattern type, location, and direction.
 - 9. Pile direction.
 - 10. Type, color, and location of insets and borders.
 - 11. Type, color, and location of edge, transition, and other accessory strips.
 - 12. Transition details to other flooring materials.
- D. Samples for initial selection in the form of manufacturer's color charts or Samples of materials showing the full range of colors, textures, and patterns available for each type of carpet tile indicated.
- E. Samples for verification of the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work. Label each sample with the manufacturer's name, material

type, color, pattern, and designation indicated on Drawings and carpet tile schedule. Submit the following:

1. Full-size sample of each type of carpet tile required.
2. 12-inch (300-mm) Samples of each type of exposed edge stripping and accessory item.

F. Schedule of carpet tile using same room designations indicated on Drawings.

G. Maintenance data for carpet tile to include in the operation and maintenance manual specified in Division 1. Include the following:

1. Methods for maintaining carpet tile, including manufacturer's recommended frequency for maintaining carpet tile.
2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance. Include cleaning and stain-removal products and procedures.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is certified by the Floor Covering Installation Board (FCIB) or who can demonstrate compliance with FCIB certification program requirements.

B. Single-Source Responsibility: Obtain each type of carpet tile from one source and by a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 5: "Storage and Handling."

B. Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.

C. Store materials on-site in original undamaged packages, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, with continuous blocking off ground.

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6: "Site Conditions."

B. Space Enclosure and Environmental Limitations: Do not install carpet tile until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

C. Subfloor Moisture Conditions: Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours (14.6 kg/1000 sq. m/24 hours) when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1, with subfloor temperatures not less than 55 deg F (12.7 deg C).

D. Subfloor Alkalinity Conditions: A pH range of 5 to 9 when subfloor is wetted with potable water and pHDrion paper is applied.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Carpet Tile Warranty: Submit a written warranty executed by carpet tile manufacturer and Installer agreeing to repair or replace carpet tile that does not meet requirements or that fails in materials or workmanship within the specified warranty period. Failures include, but are not limited to, more than 10 percent loss of face fiber, tile curling, snags, runs, and delamination.
- C. Warranty Period: 5 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
 - 1. Carpet Tile: Before installation begins, furnish quantity of full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to;
 - 1. Atlas carpet Mills
 - 2. Bolyu Contracts
 - 3. Masland Carpets, Inc.
 - 4. Mohawk Group
 - 5. Patcraft
 - 6. Shaw, Inc.
 - 7. Staticworkx, Inc.
 - 8. Tarkett, Inc.

2.2 INSTALLATION ACCESSORIES

- A. Concrete-Slab Primer: Nonstaining type as recommended by carpet tile manufacturer.
- B. Trowelable Underlayments and Patching Compounds: As recommended by carpet tile manufacturer.
- C. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated and to comply with flammability requirements for installed carpet tile as recommended by carpet tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine subfloors and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting performance of carpet tile. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Verify that subfloors and conditions are satisfactory for carpet tile installation and comply with requirements specified in this Section and those of carpet tile manufacturer.

3.2 PREPARATION

- A. General: Comply with carpet tile manufacturer's installation recommendations to prepare substrates indicated to receive carpet tile installation.
- B. Level subfloor within 1/4 inch in 10 feet (6 mm in 3 m), noncumulative, in all directions. Sand or grind protrusions, bumps, and ridges. Patch and repair cracks and rough areas. Fill depressions.
 - 1. Use leveling and patching compounds to fill cracks, holes, and depressions in subfloor as recommended by carpet tile manufacturer.
- C. Remove subfloor coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone.
- D. Broom or vacuum clean subfloors to be covered with carpet tile. Following cleaning, examine subfloors for moisture, alkaline salts, carbonation, or dust.
- E. Concrete-Subfloor Preparation: Apply concrete-slab primer, according to manufacturer's directions, where recommended by carpet tile manufacturer.
- F. Wood-Subfloor Preparation: Apply wood-floor sealer, according to manufacturer's directions, where recommended by carpet tile manufacturer.
- G. Resilient-Flooring Substrate Preparation: Replace missing pieces of existing resilient flooring or patch to level. Cut out peaked seams and fill with latex underlayment as recommended by manufacturer. Repair depressions with material recommended by carpet tile manufacturer.
- H. Terrazzo-Subfloor Preparation: Patch grout lines and cracks to level with latex underlayment as recommended by carpet tile manufacturer.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 13: "Carpet Modules (Tiles)."
- B. Where demountable partitions or other items are indicated for installation on top of finished carpet tile floor, install carpet tile before installation of these items.
- C. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

- D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- E. Install borders parallel to walls.

3.4 CLEANING

- A. Perform the following operations immediately after completing installation:
 - 1. Remove visible adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove protruding yarns from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.

3.5 PROTECTION

- A. General: Comply with CRI 104, Section 15: "Protection of Indoor Installation."
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure carpet tile is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09690

SECTION 09900 - PAINTING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
1. Exposed exterior items and surfaces.
 2. Exposed interior items and surfaces.
 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork and casework.
 - b. Acoustical wall panels.
 - c. Finished mechanical and electrical equipment.
 - d. Light fixtures.
 - e. Distribution cabinets.
 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Ceiling plenums.
 - b. Pipe spaces.
 - c. Duct shafts.
 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.

- e. Bronze and brass.
 - 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
 - 5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections include the following:
- 1. Division 2 Section "Hot-Mix Asphalt Paving" for traffic-marking paint.
 - 2. Division 2 Section "Portland Cement Concrete Paving" for traffic-marking paint.
 - 3. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
 - 4. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
 - 5. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.
 - 6. Divisions 15 and 16: Painting of mechanical and electrical work is specified in Divisions 15 and 16, respectively.

1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
- 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 5 and 20 when measured at a 60-degree meter.
 - 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
 - 4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 - 5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
- 1. Material List: Provide 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. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
 - 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1. After color selection, the Architect will furnish color chips for surfaces to be coated.
- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
- 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.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.
1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
 - a. Wall Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m) of wall surface.
 - b. Small Areas and Items: The Architect will designate an item or area as required.
 2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
 - a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.
 3. Final approval of colors will be from job-applied samples.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.

5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg 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.

1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.
- B. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
1. Benjamin Moore & Co. (Moore).
 2. Carboline, Inc.
 3. Devoe & Raynolds Co. (Devoe).
 4. Dunn-Edwards (D-E).
 5. Fuller-O'Brien Paints (Fuller).

6. Glidden Co. (The) (Glidden).
7. PPG Industries, Inc. (PPG).
8. Pratt & Lambert, Inc. (P & L).
9. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat 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.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide color selections made by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. 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 the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 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 the 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 the substrates of substances that could impair the 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 particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
 2. **Cementitious Materials:** Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. 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 of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint 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 paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
 3. **Ferrous Metals:** 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 the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
 - 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, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
 4. **Galvanized Surfaces:** Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. **Materials Preparation:** Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. **Tinting:** Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the 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.

3.3 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.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.
2. Heat exchangers.
3. Tanks.
4. Ductwork.
5. Insulation.
6. Motors and mechanical equipment.
7. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:

1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

- A. Concrete, Stucco, and Masonry (Other than Concrete Masonry Units): Provide the following finish systems over exterior concrete, stucco, and brick masonry surfaces:
 - 1. Flat Acrylic Finish: 2 finish coats over a primer.
 - a. Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
 - 1) Dunn-Edwards (ESPR00) EFF-STOP Premium, Masonry Primer/Sealer
 - 2) Moore: Primer not required over this substrate.
 - b. First and Second Coats: Flat, exterior, acrylic-emulsion paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).
 - 1) Dunn-Edwards (W704V) ACRI-FLAT, Exterior Masonry Flat Paint
 - 2) Moore: MoorLife Latex House Paint #105.
- B. Concrete Masonry Units: Provide the following finish systems over exterior concrete masonry units:
 - 1. Flat Acrylic Finish: 2 finish coats over a block filler.
 - a. Block Filler: High-performance, latex block filler applied at spreading rate recommended by the manufacturer to achieve a total dry mill thickness of not less than 4.0 mils (0.102 mm).
 - 1) Dunn-Edwards (SBPR00) Smooth BLOCFIL Premium
 - 2) Moore: Moorcraft Interior & Exterior Block Filler #173.
 - b. First and Second Coats: Flat, exterior, acrylic paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).
 - 1) Dunn-Edwards (W704V) ACRI-FLAT, Exterior Masonry Flat Paint
 - 2) Moore; MoorLife Latex House Paint #105.
- C. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.
 - a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).
 - 1) Devoe: 13101 Mirrolac Rust Penetrating Metal Primer.
 - 2) Fuller: 621-04 Blox-Rust Alkyd Metal Primer.
 - 3) Glidden: 5205 Glid-Guard Tank & Structural Primer, Red.
 - 4) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
 - 5) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
 - 6) P & L: S/D 1009 Suprime "9" Interior/Exterior Alkyd Metal Primer.
 - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).
 - 1) Devoe: 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint.
 - 2) Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
 - 3) Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
 - 4) Moore: MoorGlo Latex House & Trim Paint #096.
 - 5) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
 - 6) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.

- D. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:
 1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a galvanized metal primer.
 - a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
 - 1) Devoe: 8502/8520 Mirrolac-WB Interior/Exterior Waterborne Flat DTM Primer and Finish.
 - 2) Fuller: 621-05 Blox-Rust Latex Metal Primer.
 - 3) Glidden: 5205 Glid-Guard Tank & Structural Primer, Red.
 - 4) Moore: IronClad Galvanized Metal Latex Primer #155.
 - 5) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - 6) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
 - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

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| 1) | Devoe: | 17XX Wonder-Shield Semi-Gloss Exterior Acrylic Latex House and Trim Paint. |
| 2) | Fuller: | 664-XX Weather King II Semi-Gloss House & Trim Paint. |
| 3) | Glidden: | 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint. |
| 4) | Moore: | MoorGlo Latex House & Trim Paint #096. |
| 5) | PPG: | 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint. |
| 6) | P & L: | Z/F 3100 Series Aqua Royal Latex House & Trim Finish. |

3.8 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Flat Acrylic Finish: 2 finish coats over a primer.

- a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

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| 1) | Devoe: | 50801 Wonder-Tones Interior Vinyl Latex Primer-Sealer. |
| 2) | Fuller: | 220-20 Pro-Tech Interior Latex Wall Primer and Sealer. |
| 3) | Glidden: | 5111 Spred Ultra Latex Primer-Sealer. |
| 4) | Moore: | Regal First Coat Interior Latex Primer & Underbody #216. |
| 5) | PPG: | 17-10 Quick-Drying Interior Latex Primer-Sealer. |
| 6) | P & L: | Z/F 1004 Suprime "4" Interior Latex Wall Primer. |

- b. First and Second Coats: Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).

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| 1) | Devoe: | 36XX Wonder-Tones Interior Latex Flat Wall Paint. |
| 2) | Fuller: | 202-XX Acrylic Latex Wall Paint. |
| 3) | Glidden: | 4000 Series Spred Ultra Flat Latex Wall and Trim Paint. |
| 4) | Moore: | Regal Wall Satin #215. |
| 5) | PPG: | 80 Line Wallhide Interior Wall Flat Latex Paint. |
| 6) | P & L: | Z/F 2000 Series Vapex Latex Flat Wall Finish. |

2. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

- a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

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| 1) | Devoe: | 50801 Wonder-Tones Interior Vinyl Latex Primer-Sealer. |
| 2) | Fuller: | 220-20 Pro-Tech Interior Latex Wall Primer and Sealer. |

- 3) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
- 4) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
- 5) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
- 6) P & L: Z/F 1004 Suprime "4" Interior Latex Wall Primer.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

- 1) Devoe: 34XX Wonder-Tones Interior Latex Eggshell Enamel.
- 2) Fuller: 212-XX AA Enamel Acrylic Latex Eggshell Enamel.
- 3) Glidden: 4100 Series Spred Ultra Eggshell Latex Wall & Trim Paint.
- 4) Moore: Moore's Regal AquaVelvet #319.
- 5) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
- 6) P & L: Z/F 4000 Series Accolade Interior Velvet.

B. Woodwork and Hardboard: Provide the following paint finish systems over new, interior wood surfaces:

1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a wood undercoater.

a. Undercoat: Alkyd- or acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

- 1) Devoe: 51701 Wonder-Prime All-Purpose Latex Primer Sealer & Vapor Barrier.
- 2) Fuller: 220-07 Interior Alkyd Enamel Undercoat.
- 3) Glidden: UH 400 Ultra-Hide Alkyd Interior Enamel Undercoater.
- 4) Moore: Moore's Alkyd Enamel Underbody #217.
- 5) PPG: 6-755 Speedhide Interior Water-Based Undercoater.
- 6) P & L: Z/F 1001 Suprime "1" 100 Percent Acrylic Multi-Purpose Primer.

b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

- 1) Devoe: 39XX Wonder-Tones Semi-Gloss Interior Latex Enamel.
- 2) Fuller: 214-XX AA Enamel Interior Acrylic Latex Semi-Gloss Enamel.
- 3) Glidden: 8200 Series Spred Ultra Latex Semi-Gloss Enamel.
- 4) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333.

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| 5) | PPG: | 88-110 Satinhide Interior Enamel Wall & Trim Lo-Lustre Semi-Gloss Latex. |
| 6) | P & L: | Z/F 4100 Series Accolade Interior Semi-Gloss. |

C. Stained Woodwork: Provide the following stained finishes over new, interior woodwork:

1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sealer coat and an alkyd-based, interior wood stain. Wipe wood filler before applying stain.
 - a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.
 - 1) Devoe: None required.
 - 2) Fuller: 680-00 Pen-Chrome Paste Wood Filler.
 - 3) Glidden: Glidden Paste Wood Filler.
 - 4) Moore: Benwood Paste Wood Filler #238.
 - 5) PPG: None required.
 - 6) P & L: None required.
 - 7) S-W: Sher-Wood Fast-Dry Filler.
 - b. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.
 - 1) Devoe: 96XX WoodWorks Alkyd Interior Stain.
 - 2) Fuller: 640-XX Pen-Chrome Interior Oil Base Wood Stain.
 - 3) Glidden: 1600 Series Woodmaster Oil Wood Stain.
 - 4) Moore: Benwood Penetrating Stain #234.
 - 5) PPG: 77-302 Rez Interior Semi-Transparent Stain.
 - 6) P & L: S-Series Tonic Wood Stain.
 - 7) S-W: Oil Stain A-48 Series.
 - c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
 - 1) Devoe: 4900 WoodWorks Quick-Dry Clear Sealer.
 - 2) Fuller: None recommended.
 - 3) Glidden: 5035 Ultra-Hide Quick-Dry Sanding Sealer, Clear.
 - 4) Moore: Moore's Interior Wood Finishes Quick-Dry Sanding Sealer #413.
 - 5) PPG: 77-30 Rez Interior Quick-Drying Sealer and Finish.
 - 6) P & L: H-40 Sanding Sealer.
 - 7) S-W: ProMar Varnish Sanding Sealer B26V3.
 - d. First and Second Finish Coats: Alkyd-based or polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.
 - 1) Devoe: 4600 WoodWorks Alkyd Satin Varnish.
 - 2) Fuller: 653-01 EPA Compliant Clear Polyurethane Satin Finish.
 - 3) Glidden: 82 Satin Sheen Woodmaster Polyurethane Clear Finishes Varnish.

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| 4) | Moore: | Benwood Satin Finish Varnish #404. |
| 5) | PPG: | 77-7 Rez Varnish, Interior Satin Oil Clear. |
| 6) | P & L: | H24 38 Clear Finish Gloss. |
| 7) | S-W: | Oil Base Varnish, Gloss A66V91. |

D. Natural-Finish Woodwork: Provide the following natural finishes over new, interior woodwork:

1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sanding sealer. Provide wood filler on open-grain wood before applying first varnish coat.

- a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.

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| 1) | Devoe: | None required. |
| 2) | Fuller: | 680-00 Pen-Chrome Paste Wood Filler. |
| 3) | Glidden: | Glidden Paste Wood Filler. |
| 4) | Moore: | Benwood Paste Wood Filler #238. |
| 5) | PPG: | None required. |
| 6) | P & L: | None required. |
| 7) | S-W: | Sher-Wood Fast-Dry Filler. |

- b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.

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| 1) | Devoe: | 4900 WoodWorks Quick-Dry Clear Sealer. |
| 2) | Fuller: | None recommended. |
| 3) | Glidden: | 5035 Ultra-Hide Quick-Dry Sanding Sealer, Clear. |
| 4) | Moore: | Moore's Interior Wood Finishes Quick-Dry Sanding Sealer #413. |
| 5) | PPG: | 77-30 Rez Interior Quick-Drying Sealer and Finish. |
| 6) | P & L: | H-40 Sanding Sealer. |
| 7) | S-W: | ProMar Varnish Sanding Sealer B26V3. |

- c. First and Second Finish Coats: Alkyd-based or polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.

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| 1) | Devoe: | 4600 WoodWorks Alkyd Satin Varnish. |
| 2) | Fuller: | 653-01 EPA Compliant Clear Polyurethane Satin Finish. |
| 3) | Glidden: | 82 Satin Sheen Woodmaster Polyurethane Clear Finishes Varnish. |
| 4) | Moore: | Benwood Satin Finish Varnish #404. |
| 5) | PPG: | 77-7 Rez Varnish, Interior Satin Oil Clear. |
| 6) | P & L: | H24 38 Clear Finish Gloss. |
| 7) | S-W: | Oil Base Varnish, Gloss A66V91. |

END OF SECTION 09900

SECTION 10200 - LOUVERS AND VENTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fixed, formed-metal louvers.
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 9 Section "Painting" for field painting louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section, unless otherwise defined in this Section or in referenced standards.
- B. Standard Free Area: Free area of a louver 48 inches (1220 mm) wide by 48 inches (1220 mm) high, identical to that provided.
- C. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 inches (1220 mm) wide by 48 inches (1220 mm) high, identical to that provided.
- D. Drainable-Blade Louver: Louver designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions.

1.4 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

1.5 QUALITY ASSURANCE

- A. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 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. Airline Products Co.
 - 2. All-Lite Louver Co.
 - 3. Arrow United Industries.
 - 4. Construction Specialties, Inc.
 - 5. Nystrom
 - 6. Industrial Louvers, Inc.
 - 7. Ruskin Manufacturing; Tomkins Industries, Inc.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.
- E. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- F. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
- G. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel type, unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions, unless continuous vertical assemblies are indicated.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Louver Construction: Provide fixed-blade louvers with extruded-aluminum frames and blades.
- B. Horizontal Louvers: Either drainable- or nondrainable-blade type complying with the following:
 - 1. Louver Depth: 4 inches (100 mm), unless otherwise indicated.
 - 2. Frame Thickness: 0.125 inch (3.18 mm).
 - 3. Blade Thickness: 0.125 inch (3.18 mm).

2.5 FIXED, FORMED-METAL LOUVERS

- A. Louver Construction: Provide fixed-blade louvers with frames and blades formed from metal sheet of metal indicated.
- B. Horizontal Louvers: Either drainable- or nondrainable-blade type complying with the following:
 - 1. Louver Depth: 4 inches (100 mm), unless otherwise indicated.
 - 2. Frame and Blade Material: Stainless-steel sheet, 0.0625 inch (1.6 mm).

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish louvers after assembly.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying 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 (0.04 mm), medium gloss.
 - 2. Color: As selected by Architect from manufacturer's full range of colors.

2.8 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating of type suited to organic coating applied over it.
- B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with not less than 1.0-mil (0.025-mm) dry film thickness for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2.0 mils (0.05 mm).
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate Setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

- A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
 - 1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 10200

SECTION 10210 – AIR NOZZLES AND ROUND GRILLES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Air nozzles and round grilles for HVAC.
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 15 Sections for nozzles and grilles that are a part of mechanical equipment.

1.5 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.
 - 1. For installed nozzles and grilles and vents indicated to comply with design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
- D. Samples for Verification: Of each type of metal finish required, prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- E. Product Certificates: Signed by manufacturers of nozzles and grilles certifying that the products furnished comply with requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.
- F. Product Test Reports: Indicate compliance of products with requirements based on comprehensive testing of current products.
- G. Qualification Data: For firms and persons specified in "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.

1.6 QUALITY ASSURANCE

- B. Source Limitations: Obtain nozzles and grilles and vents through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied color finish.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating nozzles and grilles without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Krueger HVAC.
- B. Products: Punkah Nozzles RPN Series, model RPNRD
 - 1. The supply punkah nozzle shall be a Krueger model RPNRD constructed of heavy gauge aluminum. This nozzle must have directional control no less than 70° of global rotation. The lange of the RPNRD shall have a minimum of 4 screw holes on the side of the lange for mounting to the end of a stub duct. A felt gasket shall be located between the nozzle and he frame of the ball and socket joint to provide a tight air seal.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
- D. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

- E. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

2.3 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.4 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate Setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

- A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
- B. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- C. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Test operation of adjustable nozzles and grilles and adjust as needed to produce fully functioning units that comply with requirements.
- B. Periodically clean exposed surfaces of nozzles and grilles and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

- D. Protect nozzles and grilles and vents from damage during construction. Use temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at the time of Substantial Completion.
- E. Restore nozzles and grilles and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 10200

SECTION 10316 – MANUFACTURED FIREPLACES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Manufactured Wood Fireplaces.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 6 Section "Rough Carpentry" for wood framing.
 - 2. Division 6 Section "Miscellaneous Carpentry" for wood furring and grounds.
 - 3. Division 9 Sections "Gypsum Board Assemblies".

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: Manufacturer's printed data including materials, accessories, construction, finishes, assembly, and installation instructions for lockers and benches.
- F. Maintenance Instructions: Instructions for cleaning lockers and for adjusting, repairing, and replacing locker doors and latching mechanisms.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.
- B. Protect lockers from damage during delivery, handling, storage, and installation.

PART 2 - PRODUCTS

2.1 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. Fireplace X – a division of Travis Industries..
 - 2. FMI

3. Majestic Fireplaces
4. Napoleon Fireplaces
5. Superior Fireplaces.
6. Earthcore Isokern Fireplaces.

2.1 WOOD BURNING MANUFACTURED FIREPLACES

General: Basis of Design fireplace is Travis Industries Fireplace Xtrordinair wood burning manufactured fireplaces.

1. Comply with applicable building codes.
 2. Comply with UL 127.
 3. Comply with portions of UL 1482 and UL 907.
 4. Provide Posi-pressure whole heating system with external air kit and blower.
 5. Provide duct from fireplace to external air intake.
 6. Provide with cooling vents including two 12 inch (305 mm) lengths of vent and storm collars and vent hoods.
 7. Include log grate.
- B. Model 36 Elite: Mid-sized wood burning fireplace for up to 24 inch (610 mm) logs and featuring the Posi-pressure whole heating system No. 98500104.
1. Framing Dimensions: 43 inches (1092 mm) wide by 45-1/2 inches (1157 mm) high by 26 inches (660 mm) deep.
 2. Chimney: 8 inches (203 mm) inner diameter. Use Temco 82, Superior TF8, FMI 8DM or Marco 8D chimney systems.
 3. Door Styles:
 - a. Classic Arch, Black painted double doors w/ clear glass No. 98500456.
 4. Arched Faces:
 - a. Elite face, Black Painted No. 98500556.
 5. Accessories:
 - a. Black painted pressure fit door screen No. 99300227.
 - b. Extension Cord, 8 foot (2.44 m) with junction box No. 98500718

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.
- C. Verify proper power supply and fuel source are available.

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 in accordance with manufacturer's instructions, ANSI Z21.44 and the requirements of authorities having jurisdiction.
- B. Use manufacturer's guidelines for minimum clearances to combustibles, walls, and finishes.
- C. Anchor all components firmly in position for long life under hard use.
- D. Upon completion of installation, visually inspect all exposed surfaces. Touch up scratches and abrasions with touch up paint recommended by the manufacturer; make imperfections invisible to the unaided eye from a distance of 5 feet (1.5 m).

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 10316

SECTION 10350 - FLAGPOLES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Aluminum flagpoles.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for concrete footings for flagpoles, if any, and if not specified in this Section.
 - 3. Division 7 Section "Joint Sealants" for elastomeric sealant filling the top of the foundation tube, if any.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads as determined according to the building code in effect for this Project or NAAMM FP 1001, "Guide Specifications for Design Loads of Metal Flagpoles," whichever is more stringent.
 - 1. Base flagpole design on maximum standard-size flag suitable for use with pole or flag size indicated, whichever is more stringent.
 - 2. Basic Wind Speed: For Project location, 70 mph (31 m/s).

1.4 SUBMITTALS

- A. Product Data: For each type of flagpole required. Include installation instructions.
- B. Shop Drawings: Show general layout, jointing, grounding method, and anchoring and supporting systems.
 - 1. Include details of foundation system for ground-set poles.
- C. Structural Calculations: For flagpoles indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Finish Samples for Verification: For each finished metal used for flagpoles and accessories.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each flagpole as a complete unit from a single manufacturer, including fittings, accessories, bases, and anchorage devices.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Spiral wrap flagpoles with heavy kraft paper or other weathertight wrapping and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3. Eder Flag Manufacturing Co., Inc.

2.2 FLAGPOLES

- A. Pole Construction, General: Construct poles and ship to Project site in one piece, if possible. If more than one piece is necessary, provide snug-fitting precision joints with self-aligning, internal splicing sleeve arrangement for weathertight, hairline field joints.
- B. Aluminum Flagpoles: Fabricate from seamless, extruded tubing complying with ASTM B 241 (ASTM B 241M), alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm). Heat treat after fabrication to comply with ASTM B 597, temper T6.
 - 1. Provide cone-tapered aluminum flagpoles.
 - 2. Provide entasis-tapered aluminum flagpoles.
- G. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.0635-inch (1.6-mm) minimum wall thickness, sized to suit flagpole and installation. Provide with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) 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.
- I. Baseplate: Cast-metal shoe base for anchor-bolt mounting, of same metal and finish as flagpole. Provide with anchor bolts.
 - 1. Provide ground spike at pavement-mounted metal flagpoles.

2.3 FITTINGS

- A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match pole-butt diameter.
 - 1. 0.063-inch (1.6-mm) spun aluminum, finished to match flagpole.
- B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, 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.

- E. Halyard Flag Snaps: Provide 2 swivel snap hooks per halyard, as follows:
 - 1. Chromium-plated bronze.

2.4 MISCELLANEOUS MATERIALS

- B. Concrete: Provide concrete composed of portland cement, coarse and fine aggregate, and water mixed in proportions to attain a 28-day compressive strength of not less than 3000 psi (20 MPa), complying with ASTM C 94.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- D. Sand: ASTM C 33, fine aggregate.
- E. Elastomeric Sealant: Comply with requirements of Division 7 Section "Joint Sealants."

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Aluminum: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
 - 1. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare in-ground flagpoles by painting below-grade portions with a heavy coat of bituminous paint.
- B. Excavation: For foundation, 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 forms, foundation tube, fiberglass sleeve, or anchor bolts in position, braced to prevent displacement during concreting.
- D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moisture cure exposed concrete for not less than 7 days or use a 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 base perimeter.

3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles 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 (50-mm) layer of elastomeric sealant and cover with flashing collar.
- C. Baseplate Installation: Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION 10350

SECTION 10351 – BICYCLE RACKS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY, SECTION INCLUDES

- A. Fixed metal bicycle racks.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of finish indicated
- C. Product Layout Drawings: For layout options and site dimensions.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications A company specialized in the manufacture of metal bicycle racks.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inspect bicycle racks components on delivery for carrier damage. Store bicycle racks components in original undamaged packaging in an area sheltered from weather until ready for installation. Inspect bicycle locker components prior to setup and installation.

1.7 WARRANTY

- A. Warranty covers materials and workmanship
- B. Warranty Period:
 - 1. One (1) year from date of invoice for all manufacturer's components
- C. Warranty does not cover improper installation, neglect, misuse, accidents, vandalism, natural disasters, fire, or acts of war or terrorism.

PART 2 - PRODUCTS

2.1 BICYCLE RACKS

- A. Bicycle Rack shall be CycLoops™ Circulo model No. 2170-3-04 in the material and color finish selected by the owner's representative and in the quantity shown on the bill of materials or the project drawings. Manufacturer, Columbia Cascade Company, 1300 SW Sixth Avenue, Suite 310, Portland OR 97201-3464 U.S.A.

2.2 MATERIALS

- A. Bicycle Rack shall be one-piece 2-inch square steel or stainless steel tubing. Standard surface mount (-SM) bases shall be manufactured from 1/4 inch thick mild steel plate, permanently welded to pipe ends and include two 5/8" dia. holes each for anchor bolts furnished by installing contractor. Optional embedment mount (-E) legs shall extend ten inches below finished grade and be drilled to accept No. 4 re-bar furnished by installing contractor.

2.3 CONSTRUCTION

- A. Curved Bicycle Rack shape shall be derived from constant 1'-5" radius bend through 306 degrees. Bending that distorts the pipe is not allowed. Bicycle Rack shall be deburred and ground smooth after fabrication.

2.3 FINISH

- A. (-C) Steel shall be coated with CASPAX-7, a tough, opaque, UV resistant exterior grade polyester powder coating applied to a minimum thickness of 6 mils. Liquid, epoxy or lead-containing powder coatings are not acceptable.
- B. Preparation of the mild steel substrate shall incorporate the phosphate system. Substrate preparation shall consist first of mechanical cleaning to remove heavy mill scale, rust, varnish, grease, etc., with surfaces uniformly abraded to promote quality of finish coating. Chemical cleaning in accordance with TT-C-490C, Methods I and III shall remove impurities from the surfaces.
- C. After the two-step cleaning process, the metal substrate shall receive a corrosion-inhibiting iron phosphate pre-coating in accordance with TT-C-490C, Type II, prior to the application of the powder color coat. The color coating shall be applied by the electrostatic method and then oven-cured at 400 degrees Fahrenheit to chemically bond the coating to the substrate and to render the coated metal resistant to abrasion, impact, chipping, weathering, and rusting.
 - 1. (-S) Stainless steel bicycle rack shall have No. 4 polish finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Where installation on concrete is specified, install racks on minimum 4 inch thick concrete slabs, sloped to provide drainage (maximum 2 degrees). For other improved surfaces, such as pavers or asphalt, contact Manufacturer for alternate installation procedures.
- B. Fasten to concrete slab or improved surfaces with 1/4 inch Hammer Drive Pin style expansion anchors.
- C. Set plumb and aligned. Level racks true to plane with leveling plates and shims.

END OF SECTION 10351

SECTION 10352 – BICYCLE STORAGE LOCKERS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY, SECTION INCLUDES

- A. High Strength Sheet Molding Compound (HSMC) plastic composite, modular Hybrid Bicycle Storage Lockers with HRS Steel Frames & End Panels.

1.3 SUBMITTALS FOR REVIEW

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of finish indicated
- C. Product Layout Drawings: For layout options and site dimensions.

1.4 SUBMITTALS FOR INFORMATION

- A. Manufacturer information: "Installation Guide & Owner's Manual - EcoPark Series".
- B. Maintenance Data: Included in Owner's Manual
- C. Certifications: For exterior HSMC Molded material, certified by manufacturer.

1.5 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.
- C. Conformance: Conform to Class I Bicycle Parking Facilities requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inspect bicycle locker components on delivery for carrier damage. Store bicycle locker components in original undamaged packaging in an area sheltered from weather until ready for installation. Inspect bicycle locker components prior to setup and installation.

1.7 WARRANTY

- A. Warranty covers materials and workmanship
- B. Warranty Period:
 - 1. One (1) year from date of invoice for all manufacturer's non-HSMC components.
 - 2. Five (5) years from date of invoice for failure of HSMC composite material with exterior coatings due to corrosion.
- C. Warranty period for mechanical locks: One (1) year from date of invoice.
- D. Warranty does not cover improper installation, neglect, misuse, accidents, vandalism, natural disasters, fire, or acts of war or terrorism.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA & CONSTRUCTION

- A. Bicycle Lockers System: Hybrid design HSMC top and door panels with powder coated steel frames, dividers and end panels for rigidity and less heat retention than all steel lockers. The lockers provide a sturdy enclosure, adequate security and capacity within for storing most conventional bike sizes. They are aesthetically pleasing, and are weather and graffiti resistant. Require less shipping and storage area than assembled lockers. Pre-assembled lockers available as an option.
- B. Top Panels: Fiberglass HSMC top panels provide high mechanical strength and rigidity, high surface quality, reduced heat build-up, and rust or denting resistance.
 - 1. Material: Hot compression molded fiberglass reinforced plastic (HSMC) using polyester resin.
 - 2. Construction: Crowned stipple textured surface with 2 inch deep reinforced ribs and flush construction parallel to the Door Panel.
- C. End Panels: Dimpled cross pattern impressions with stiffeners.
 - 1. Material: Powder coated HRS 16 gauge sheet steel
 - 2. Construction: Dimpled cross pattern with welded stiffener angles for rigidity, and welded nuts for easy installation.
- D. Design bicycle storage assemblies and provide clearances that will allow for installation tolerances and free unobstructed access to users.
- E. Doors: Manufactured to same material standards as the locker top and include recessed tamper proof door jambs. Doors should open and close easily without being forced.
 - 1. Integrated full length Latching System to help prevent door prying
 - 2. Material: Hot compression molded fiberglass reinforced plastic (HSMC) using polyester resin.
 - 3. Construction: Crowned stipple textured surface with 2 inch deep reinforced ribs and flush construction parallel to the Top Panel.
 - 5. Polycarbonate 1/4 inch X 11 inches X 11 inches viewing port.

- F. Door Locks: Pop-out T-Handle Vending type mechanism with medium security removable UL 437 listed plug type cylinder lock for T-handle. Locks are recessed and mounted internally for security.
1. Key each locker door cylinder separately and supply (2) keys with each.
 2. All lock cylinders shall be completely re-keyable to new combinations.
 3. Contractor to label door keys with corresponding locker door number.
 4. Lock Cylinders: CompX ACE II 7 medium security vending machine type with tubular keys as manufactured by Chicago Locks or approved equal.
 5. T-Handle Assembly: NAMA Rotary Vending Standard countersunk within door face.
 6. Replacement Cylinders and Keys available at retail level Lock Smiths.
- G. Identification: To be provided by Owner, an (optional) numerical identification aluminum plate with 3/4 inch high photo etched numbers and stainless steel escutcheon plate for locker door available.
- H. Roof: Passive draining, having crowned top panels to remove water.
- I. Leveling Brackets: Vertical adjustment of two (2) inches
1. Concealed adjustable leveling feet for un-even surfaces (optional)
- J. Anchors: Securely attach lockers to mounting surface, where specified, on inside of locker.
1. Anchors and Fasteners to be structurally stressed not more than 50 percent of allowable stress when maximum loads are applied.
- K. Hinge: Concealed, full length, piano hinge, corrosion resistant finish, 14 gauge. steel with stainless steel rod. Pop-riveted attachment is not allowed.
- L. Partitions: For dividing lockers into two compartments and separating lockers.
1. Exterior type Orientated Strand Board (OSB) panels or equivalent material with sealed edges and coated surfaces (standard).
 2. HRS Steel with deburred edges and powder coated (optional).
 3. Perforated metal panels (custom).
 4. Diagonal "Divider" Partition not required (Single-Entry).

2.2 BICYCLE STORAGE LOCKERS DESCRIPTION

- A. Series: CycleSafe EcoPark in RAL 7047 Gibraltar
- B. Models: Single-Tier 2 bike capacity.
1. Door-View: DV, windows in doors only
 2. Double-Entry: two-door access (M02) 19501
- C. Locker Dimensions:
1. Height: 4 feet, 2 1/4 inches.
 2. Width: (Starter) 2 feet, 9 inches
 3. Depth: 6 feet, 5 1/2 inches.
 4. Row Length: Varies depending upon banking configurations.
- D. Bicycle Parking Spaces: Locker Capacity

1. Two-door, double ended access lockers: Two (2) triangular interior spaces per two-door locker unit to be no less than forty-six (46) inches high, seventy (70) inches deep, twenty-nine (29) inches wide at opening and two (2) inches wide at rear.

2.3 ACCESSORIES

- A. Swing-Handle Latch with stainless steel bracket for utilizing 3/8" thick Padlock or standard 3/4" maximum thickness bicycle U-Lock. Mfr. # 19549.
- B. Master keys will be sent by registered mail or UPS AOD (acknowledgement of delivery) from factory directly to the Owner (optional) .
- C. Locker Door Identification Number Plates: Manufacturer's standard photo etched aluminum plate, concealed mounting, sequentially numbered with black numbers or letters of at least 3/4 inch (19mm) high. Mfr. # 10703.
- D. End Panel Options:
 1. Bike logo silhouette vinyl sticker. Mfr. # 19915
- J. Blue 2-3/8 inch x 4-5/8 inch Bike Parking Decal: Mfr # 195799.

2.4 FINISHES

- A. Top and Doors: Factory applied oven baked on, semi-gloss stipple texture finish.
- B. Frame: Zinc Primed TGIC powder coated steel.
- C. End Panels: Zinc Primed TGIC powder coated steel.
- D. Partitions: Light Tan Water Base coating on all sides and edges
- E. Locker Color: "Sandstone"; manufacturer standard locker color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Where installation on concrete is specified, install lockers on minimum 4 inch thick concrete slabs, sloped to provide drainage (maximum 2 degrees). For other improved surfaces, such as pavers or asphalt, contact Manufacturer for alternate installation procedures.
- B. Fasten to concrete slab or improved surfaces with 1/4 inch Hammer Drive Pin style expansion anchors (furnished).
- C. Set plumb and aligned. Level lockers true to plane with leveling plates and shims.
- D. Field alteration of doors and frames to accommodate field conditions is prohibited.

- E. Adjust doors, latching bar fastening screws, and hardware to operate smoothly, easily, properly, and without binding.

END OF SECTION 10352

SECTION 10522 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

1.4 QUALITY ASSURANCE

- A. UL-Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.
- B. FM-Listed Products: Fire extinguishers approved by Factory Mutual Research Corporation for type, rating, and classification of extinguisher with FM marking.

PART 2 - PRODUCTS

2.1 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. Ansul Fire Protection.
 - 2. Badger-Powhatan.
 - 3. American Specialties Inc.
 - 4. Bobrick Washroom Equipment, Inc.
 - 5. Croker Div., Fire-End and Croker Corp.
 - 6. Filtrine Manufacturing.
 - 7. Lyon Metal Products.
 - 8. J.L. Industries.

9. Larsen's Manufacturing Co.
10. Modern Metal Products by Muckle.
11. Potter-Roemer, Inc.
12. Samson Metal Products, Inc.

2.2 FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard, that comply with authorities having jurisdiction.
- B. Multipurpose Dry Chemical Type: UL-rated 2-A:10:B:C, 5-lb nominal capacity, in enameled steel container.

2.3 CABINETS

- A. Construction: Manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
- B. Fire-Rated Cabinets: UL listed with UL listing mark with fire-resistance rating of wall where it is installed.
- C. Cabinet Type: Suitable for containing the following:
 1. Fire extinguisher.
- D. Cabinet Mounting: Suitable for the following mounting conditions:
 1. Semirecessed: Cabinet box (tub) partially recessed in walls of shallow depth.
- E. Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.
 1. Trimless: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet.
 2. Trimless with hidden flange of same metal and finish as box (tub) that overlaps surrounding wall finish and concealed from view by an overlapping door.
- F. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
 1. Enameled Steel: Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.
 2. Door Glazing: Clear float glass complying with ASTM C 1036, Type I, Class 1, Quality q3.
 - a. Class 1 (clear).
- G. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
 1. Application Process: Silk screen.

- H. Door Style: Manufacturer's standard design.
 - 1. Break Glass Panel: Float glass, 1/8 inch thick, with inside latch and lock.
- I. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 deg.

2.4 FINISHES FOR CABINETS, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying temporary strippable protective covering prior to shipping.

2.5 STEEL CABINET FINISHES

- A. Surface Preparation: Solvent-clean surfaces complying with SSPS-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5 (white metal blast cleaning) or SSPC-SP 8 (pickling).
- B. Baked-Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard two-coat baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 2.0 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's standard choices for color and gloss. Paint the following:
 - a. Exterior of cabinet, except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine rough-in for hose vales, hose racks, and cabinets to verify locations of piping connections prior to cabinet installation.
- B. Examine walls and partitions for thickness and framing for cabinets to verify cabinet depth and mounting prior to cabinet installation.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Follow manufacturer's printed instructions for installation.

- B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Prepare recesses in walls for cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - 2. Fasten mounting brackets and cabinets to structure, square and plumb.

END OF SECTION 10522

SECTION 10550 - POSTAL SPECIALTIES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. mailboxes.

- B. Related Sections include the following:

- 1. Division 8 Section "Door Hardware" for lock cylinders when keyed to building keying system.

1.3 SUBMITTALS

- A. Product Data: For each type of postal specialty specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

- 1. Provide manufacturer's certification that equipment proposed complies with USPS regulations and has been approved by the Postmaster General.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain mail chutes and receiving and collection boxes through one source from a single manufacturer to ensure that mail will flow without restriction from the chute into the box.

- B. Where mail system is served by USPS, provide products approved by USPS.

- C. Requirements of Regulatory Agencies: Comply with USPS requirements for construction and installation of units served by USPS.

PART 2 - PRODUCTS

2.1 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. Horizontal and Vertical Mailboxes:

- a. American Device Manufacturing Company.
- b. Auth-Florence Manufacturing Company.
- c. Bommer Industries, Inc.
- d. Cutler Manufacturing Corporation.
- e. Jensen Industries (horizontal only).
- f. Meta-Lite, Inc.
- g. Salisbury Industries.
- h. U.S. Chutes Corp.

2.2 METALS

- A. Aluminum: Alloy and temper best suited for the intended use and finish indicated.
 1. Plate and Sheet: ASTM B 209 (ASTM B 209M), mill finish, where not exposed.
 2. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M).
- B. Steel: Cold-rolled steel sheet or plate, zinc-coated by electrodeposition, galvanized, or conversion coated for application of manufacturer's standard factory-applied, baked-enamel finish.

2.5 MAILBOXES

- A. General: Provide horizontal-type mailboxes complying with USPS Publication 17 in size and with features indicated.
- B. General: Provide horizontal-type mailboxes in size and with features indicated.
- C. Front-Loading Door: Manufacturer's standard unit, braced and framed to hold box doors in master front. Construct with continuous stainless-steel piano hinge on one side and solid closure for back of mail compartments. Fabricate unit so door remains open while mail is deposited.
 1. Locking: Construct mailboxes to receive locks provided by local postmaster for use by postal employees.
 2. Locking: Cylinder lock with 2 keys, keyed to building keying system.
- D. Rear-Loading Door: Manufacturer's standard unit with solid closure and positive-latching mechanism.
- E. Mail Compartments and Wall Receptacles: Fabricate concealed components of units from manufacturer's standard aluminum or steel sheet. Equip each compartment to receive tenant's name card.
- F. Compartment Doors and Trim: Fabricate doors and trim from extruded aluminum to suit type of installation and loading method.
 1. Identification: Plastic tabs with heat-stamped numbers on each door, as designated by Architect. For sorting, provide slots and clear plastic openings to receive tenants' name cards.
 2. Locking: Manufacturer's standard single-dial, 3-digit, combination locks. Deliver manufacturer's record of combinations to Owner.
- G. Directory: Manufacturer's standard directory unit in size and location as indicated and of same materials and finish as box frames, unless otherwise indicated.

- H. Aluminum Finish: Finish exposed-to-view surfaces as follows:
 - 1. Satin aluminum, clear anodized.
 - 2. Satin aluminum, clear coated.
 - 3. Satin aluminum, gold anodized.
 - 4. Satin bronze anodized.
 - 5. Dark oxidized, satin bronze anodized.
 - 6. Baked enamel in color selected by Architect from manufacturer's standards.
- I. Steel Finish: Manufacturer's standard baked-enamel finish in color selected by Architect from manufacturer's full range of colors.

2.10 METAL FINISHES

- A. Exposed Aluminum Finish: Manufacturer's standard matching the following BHMA finish code number, complying with ANSI/BHMA A156.18:
 - 1. Satin Aluminum, Clear Coated: BHMA Finish Code No. 627.
- B. Steel Finish: Baked enamel in color selected by Architect from manufacturer's full range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine mailroom areas and conditions for compliance with clearances and roughing-in requirements affecting installation of postal specialties. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. In addition to requirements of these Specifications, comply with manufacturer's written instructions and recommendations for preparing substrates, installing anchors, and applying postal specialty units.

3.3 INSTALLATION

- A. Install postal specialties level and plumb, according to manufacturer's written instructions, roughing-in drawings, original design, and referenced standards.
 - 1. Final acceptance depends on compliance with USPS requirements.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure postal specialties are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10550

SECTION 10800 - TOILET AND BATH ACCESSORIES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes toilet and bath accessory items as scheduled.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specifications Sections.
- B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.

1.4 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.
- B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.5 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering toilet accessories that may be incorporated in the Work include, but are not limited to, the following:
 - 1. A & J Washroom Accessories.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.

4. Bradley Corporation.
5. General Accessory Manufacturing Co.
6. McKinney/Parker.

2.2 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034 inch (0.9 mm) minimum thickness.
- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16 (ASTM B 16M); Castings, ASTM B 30.
- C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366 (ASTM A 366M), 0.04 inch (1.0 mm) minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 527 G60 (ASTM A 527M Z180).
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
- F. Mirror Glass: Nominal 6.0 mm thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.
- G. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.3 FABRICATION

- A. General: Only a maximum 1-1/2 inch (38 mm) diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product model number.
- C. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
- D. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.
- E. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:

1. Provide galvanized-steel backing sheet, not less than 0.034 inch (0.9 mm) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- F. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:
1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbf (1100 N), complying with ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10800

SECTION 11450 - LAUNDRY EQUIPMENT**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of laundry equipment:
 - 1. Laundry Washer-Extractor.
 - 2. Automatic laundry dryer for processing water-washed linen items.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Plumbing connections for laundry equipment are specified in Division 15.
 - 2. Electrical services and connections for laundry equipment are specified in Division 16.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each appliance type required indicating compliance with requirements, including installation instructions. Provide complete operating and maintenance instructions for each appliance.

1.4 QUALITY ASSURANCE

- A. Energy Ratings: Provide laundry equipment that carry labels indicating energy cost analysis (estimated annual operating costs) and efficiency information as required by Federal Trade Commission.
- B. UL and NEMA Compliance: Provide electrical components required as part of laundry equipment that are listed and labeled by UL and comply with applicable NEMA standards.
- E. Single-Source Responsibility: Obtain laundry equipment from a single supplier.
 - 1. Provide products from the same manufacturer for each type of appliance required.

1.5 DELIVERY AND STORAGE

- A. Deliver laundry equipment to the Project site in the manufacturer's undamaged protective packaging.

- B. Delay delivery of laundry equipment until utility rough-in is complete and construction in the spaces to receive laundry equipment is substantially complete and ready for installation.

1.6 WARRANTIES

- A. Warranty: Submit written warranties executed by the manufacturer of each appliance specified agreeing to repair or replace units or components that fail in materials or workmanship within the specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide laundry equipment by manufactured by one of the following:

1. Alliance Laundry Systems LLC – UniMac.
2. Continental Girbau, Inc.

- B. QUALIFIED MODELS

1. UniMac model UT050NQT (no substitutions permitted).
2. UniMac model UWN045T4V and UWN045T3V - with soap box option (no substitution)
3. UM Topload Washer-Extractor Model UM202
4. Continental EH020 E-Series 20-Pound Capacity.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations.
- B. Built-In Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

3.2 ADJUST AND CLEAN

- A. Testing: Test each item of equipment to verify proper operation. Make necessary adjustments.
- B. Accessories: Verify that accessory items required have been furnished and installed.
- C. Cleaning: Remove packing material from equipment items and leave units in clean condition, ready for operation.

END OF SECTION 11450

SECTION 11452 - RESIDENTIAL APPLIANCES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of residential appliances:
 - 1. Cooking equipment, including ranges and ovens.
 - 2. Range hoods.
 - 3. Refrigerator/freezers.
 - 4. Dishwashers.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Kitchen sinks, waste disposers and instant hot water dispensers are specified in Division 15 Section "Plumbing Fixtures."
 - 2. Plumbing connections for appliances are specified in Division 15.
 - 3. Electrical services and connections for appliances are specified in Division 16.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each appliance type required indicating compliance with requirements, including installation instructions. Provide complete operating and maintenance instructions for each appliance.

1.4 QUALITY ASSURANCE

- A. Energy Ratings: Provide residential appliances that carry labels indicating energy cost analysis (estimated annual operating costs) and efficiency information as required by Federal Trade Commission.
- B. UL and NEMA Compliance: Provide electrical components required as part of residential appliances that are listed and labeled by UL and comply with applicable NEMA standards.
- C. AGA and ANSI Standards: Provide gas-burning appliances that carry the design certification seal of the American Gas Association (AGA) and comply with ANSI Z21-Series standards.
- D. AHAM Standards: Provide appliances that conform to the following standards of the Association of Home Appliance Manufacturers:

1. Refrigerators and Freezers: Total volume and shelf area ratings certified according to ANSI/AHAM HRF-1.
- E. Single-Source Responsibility: Obtain appliances from a single supplier.
1. Provide products from the same manufacturer for each type of appliance required.
 2. To the greatest extent possible, provide appliances by a single manufacturer for entire Project.
- F. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of residential appliances and are based on the specific types and models indicated. Appliances by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.
- 1.5 DELIVERY AND STORAGE
- A. Deliver appliances to the Project site in the manufacturer's undamaged protective packaging.
 - B. Delay delivery of appliances until utility rough-in is complete and construction in the spaces to receive appliances is substantially complete and ready for installation.
- 1.6 WARRANTIES
- A. Warranty: Submit written warranties executed by the manufacturer of each appliance specified agreeing to repair or replace units or components that fail in materials or workmanship within the specified warranty period.
 1. Electric Range: 4-year limited warranty on surface burner elements.
 2. Microwave Oven: 9-year limited warranty on defects in the magnetron tube.
 3. Refrigerator/Freezer: 5-year warranty on the sealed refrigeration system.
 4. Dishwasher: 5-year warranty on the dishwasher motor and pump and 10-year warranty against rust on stainless steel components.
 - B. Warranties specified above 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering appliances that may be incorporated in the Work include, but are not limited to, the following:
 1. Admiral Company.
 2. Amana Refrigeration, Inc.
 3. Caloric Corporation.
 4. Frigidaire Appliance Company.
 5. General Electric Company.
 6. Hotpoint.
 7. Kitchen Aid, Inc.

8. Magic Chef, Inc.
9. Maytag Company.
10. Modern Maid Company.
11. Whirlpool Corporation.

2.2 ELECTRIC RANGES

- A. Freestanding Electric Range: Provide 30 inch (750 mm) wide, freestanding electric range with four-burner cooktop, oven, full-width storage drawer, and combination surface burner and oven control panel mounted above backsplash at rear of cooking surface. Provide four adjustable leveling legs.
1. Cooktop Deck: Provide hinged, tilt-up, recessed cooktop with four surface burners.
 - a. Cooktop Surface: Porcelain enamel.
 - b. Backsplash: Porcelain enamel.
 - c. Radiant-Surface Cooktop: Solid, ceramic glass cooking surface with four concealed, radiant heating elements mounted below glass surface.
 2. Oven: Provide oven with a 2500 watt bake element, a 3400 watt broil element, and an interior oven light. Include porcelain enamel interior; four rack levels; two removable, tilt-proof, chrome-plated, self-locking racks; a two-piece porcelain enamel broiler pan; and a counterbalanced removable oven door with a towel bar handle.
 - a. Oven Type: Self-cleaning.
 - b. Oven Door Type: Black glass.
 3. Control Panel: Provide combined surface burner and oven control panel. Include surface burner controls, burner "ON" indicator light, oven controls, automatic oven timer control and clock.
 - a. Control Panel Material: Black glass.
 - b. Controls: Solid-state electronic, touch type.
 - c. Microwave Oven Controls: Solid-state electronic, touch-type.
 - d. Clock Type: Digital.
 4. Storage Drawer: Provide removable, full-width storage drawer below oven.
 - a. Storage Drawer Front Panel: Black glass.
 5. Trim: Provide the manufacturer's standard, optional, trim kit, including the following:
 - a. Rear trim strip.
 - b. Backsplash.
 - c. Vertical side trim.

2.3 EXHAUST HOODS

- A. Ventilating Exhaust Hood: Provide 30 inch (750 mm) hood for mounting below wall cabinets, with two-speed fan rated at 160 cfm (75 L/s) minimum, permanent washable filter, and built-in lighting. Include exhaust duct and wall or roof cap and shutter.
1. Duct Type: 7 inch (175 mm) diameter round.
 2. Fan Exhaust: Vertical or rear exhaust.

3. Fan Control: Two-position rocker switch.
4. Finish: Stainless Steel.

2.4 REFRIGERATOR/FREEZERS

- A. Top-Mount Freezer-Type Refrigerator/Freezer: Provide freestanding, frost-free, two-door, top-mount freezer model refrigerator/freezer on adjustable rollers, and reversible doors with door shelves.
1. Capacity: Provide the following minimum values, measured according to ANSI/AHAM HRF-1 and certified by AHAM:
 - a. Total volume: 20.0 cu. ft. (0.57 cu. m).
 - b. Refrigerator volume: 14.0 cu. ft. (0.40 cu. m).
 - c. Total shelf area: 30.0 sq. ft. (2.8 sq. m).

2.5 DISHWASHERS

- A. Built-In Dishwasher: Provide under-the-counter automatic dishwasher sized to replace 24 inch (600 mm) base cabinet. Dishwasher shall be operable at water pressures from 15 to 120 psi (100 to 825 kPa) and shall not require more than 12.0 gal (45 L) of water for normal wash cycle. Provide two wash levels. Include full-extension, vinyl-coated upper and lower dish racks and removable silverware basket. Provide sound-absorbing exterior insulation blanket around tub and back to reduce noise. Include soft food disposer and self-cleaning food filter system.
1. Tub and Door Liner: Provide dishwasher with porcelain enamel interior.
 2. Wash Cycles: Provide dishwasher unit with normal wash, light (low-energy) wash, and rinse-and-hold wash cycles.
 3. Dry Cycles: Provide dishwasher unit with hot-air dry and energy-saving, heat-off, drying cycles.
 4. Control Type: Solid-state electronic, press-to-start type.
 5. Finish: Provide the manufacturer's standard, reversible panels, with choice of colors for door front and lower access panel.

2.6 FINISHES

- A. General: Provide the manufacturer's standard porcelain enamel finish.
- B. Colors: Provide manufacturer's standard colors as shown or scheduled. If no color indicated, provide white.
1. Wherever residential appliances by more than one manufacturer are installed in the same space, provide units with color matching largest equipment item.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations.

- B. Built-In Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

3.2 ADJUST AND CLEAN

- A. Testing: Test each item of residential equipment to verify proper operation. Make necessary adjustments.
- B. Accessories: Verify that accessory items required have been furnished and installed.
- C. Cleaning: Remove packing material from residential equipment items and leave units in clean condition, ready for operation.

END OF SECTION 11452

SECTION 11460 – AUTOMOTIVE VACUUM SYSTEMS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of equipment:
 - 1. Automotive Vacuum Systems.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Electrical services and connections for laundry equipment are specified in Division 16.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data indicating compliance with requirements, including installation instructions. Provide complete operating and maintenance instructions for each item.

1.4 QUALITY ASSURANCE

- A. Energy Ratings: Provide equipment that carry labels indicating energy cost analysis (estimated annual operating costs) and efficiency information as required by Federal Trade Commission.
- B. UL and NEMA Compliance: Provide electrical components required as part of equipment that are listed and labeled by UL and comply with applicable NEMA standards.
- C. Single-Source Responsibility: Obtain laundry equipment from a single supplier.
 - 1. Provide products from the same manufacturer for each type of appliance required.

1.5 DELIVERY AND STORAGE

- A. Deliver equipment to the Project site in the manufacturer's undamaged protective packaging.
- B. Delay delivery of equipment until utility rough-in is complete and construction in the spaces to receive laundry equipment is substantially complete and ready for installation.

1.6 WARRANTIES

- A. Warranty: Submit written warranties executed by the manufacturer of each item specified agreeing to repair or replace units or components that fail in materials or workmanship within the specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide laundry equipment by manufactured by the following:
 - 1. AutoVac, Industrial Vacuum & Air Systems.
- B. Vacuum systems are designed specifically for this project location, refer to manufacturer's drawings, specifications, instructions, etc. provided.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations.
- B. Built-In Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

3.2 ADJUST AND CLEAN

- A. Testing: Test each item of equipment to verify proper operation. Make necessary adjustments.
- B. Accessories: Verify that accessory items required have been furnished and installed.
- C. Cleaning: Remove packing material from equipment items and leave units in clean condition, ready for operation.

END OF SECTION 11460

SECTION 11470 – CENTRAL CHEMICAL DISPENSING SYSTEM**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of equipment:
 - 1. Automotive Central Chemical Dispensing System.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Electrical services and connections for laundry equipment are specified in Division 16.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data indicating compliance with requirements, including installation instructions. Provide complete operating and maintenance instructions for each item.

1.4 QUALITY ASSURANCE

- A. Energy Ratings: Provide equipment that carry labels indicating energy cost analysis (estimated annual operating costs) and efficiency information as required by Federal Trade Commission.
- B. UL and NEMA Compliance: Provide electrical components required as part of equipment that are listed and labeled by UL and comply with applicable NEMA standards.
- C. Single-Source Responsibility: Obtain laundry equipment from a single supplier.
 - 1. Provide products from the same manufacturer for each type of appliance required.

1.5 DELIVERY AND STORAGE

- A. Deliver equipment to the Project site in the manufacturer's undamaged protective packaging.
- B. Delay delivery of equipment until utility rough-in is complete and construction in the spaces to receive laundry equipment is substantially complete and ready for installation.

1.6 WARRANTIES

- A. Warranty: Submit written warranties executed by the manufacturer of each item specified agreeing to repair or replace units or components that fail in materials or workmanship within the specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide laundry equipment by manufactured by the following:
 - 1. Eurovac, Inc.
- B. Central Chemical Dispensing system are designed specifically for this project location, refer to manufacturer's drawings, specifications, instructions, etc. provided.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations.
- B. Built-In Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

3.2 ADJUST AND CLEAN

- A. Testing: Test each item of equipment to verify proper operation. Make necessary adjustments.
- B. Accessories: Verify that accessory items required have been furnished and installed.
- C. Cleaning: Remove packing material from equipment items and leave units in clean condition, ready for operation.

END OF SECTION 11470

SECTION 15050 - HEATING, VENTILATING AND AIR CONDITIONING**PART 1 - GENERAL**

1.1 DESCRIPTION:

- A. Division 1 applies to this Section. Provide heating, ventilating and air conditioning as indicated, specified and required.
- B. Work In This Section. Principal items include:
1. Air conditioning for 3 buildings complete with main ducts, air distribution equipment and controls.
 2. Rooftop Package A/C units with gas heating, evaporative coolers, piping and controls to provide cooling and/or heating to the spaces.
 3. Gas infrared radiant heating for the full service belt with T-24 thermostat to keep below 55F to remain unconditioned space qualified.
 4. Ventilation from all toilet rooms on all floors; ventilation for electrical room, carwash equipment rooms, vacuum rooms, vending, janitor rooms, and other areas where indicated on the drawings.
- C. Related Work Included In This Section:
1. Furnishing electrical devices necessary for mechanical work except disconnects unless indicated otherwise.
 2. Line and low voltage wiring for mechanical controls including final connections as indicated on wiring diagrams.
 3. Conduit for line and low voltage wiring for mechanical controls as indicated on wiring diagrams.
 4. Responsibility for obtaining clarification of discrepancies between mechanical and electrical work from Architect prior to proceeding with the work.
 5. Responsibility for proper operation of automatic pneumatic/electric controls and equipment and of electric power driven equipment furnished under this section.
- D. Related Work in Other Sections:
1. Painting of exposed piping, ductwork and unfinished portions of fixtures and equipment as specified in Section 09900.
 2. Concrete work including miscellaneous metal in connection with pits, trenches and catch basins with foundations or concrete pads under boilers, pumps, A/C units, cooling towers, air handling units, exhaust fans and other mechanical equipment, furnishing templates for spacing and sizes of concrete pads and anchor bolts under this section.
 3. Miscellaneous equipment furnished by Owner or under other sections except exhaust and ventilation connections for the equipment shall be made under this section.
 4. Electrical work as follows will be provided under Division 26:
 - a. Conduit for line wiring for equipment and devices as indicated or specified except conduit for low voltage wiring for mechanical controls as specified under Division 15.
 - b. Line wiring for equipment and devices as indicated or specified herein except low voltage wiring for mechanical controls as specified under Division 23.
 - c. Providing disconnect switches.

- d. Installing electrical devices such as starters and disconnects, and when indicated, furnishing all such devices.
5. Vibration isolation equipment for all mechanical equipment and piping including seismic restraints. All floor and roof mounted equipment and suspended equipment seismic restraints shall be capable of withstanding dynamic horizontal and vertical forces as prescribed for Seismic Zone 4 in the California Building Code (CBC). All ductwork and piping shall have seismic restraints in accordance with Seismic Zone 4 requirements in the CBC and applicable Title 24 standards.

1.2 QUALITY ASSURANCE:

- A. Codes and Standards: In addition to the requirements of all governing codes, ordinances and agencies having jurisdiction, conform to the requirements of the following codes and standards:
 1. State of California Administrative Code.
 2. Health and Safety Code, State of California.
 3. National Board of Fire Underwriter's Publications:
 - a. Pamphlet 70: National Electrical Code.
 - b. Pamphlet 90A: Air Conditioning Systems.
 4. 2013 Editions of the CBC, CMC and CPC
- B. Package Gas Electric Units:
 1. Units shall be US UL labeled and approved.
 2. The ECM motors shall meet UL requirements for motor over-current protection and UL 508C for controllers containing power switching devices.
 3. Acoustical data shall meet ARI 260-01

1.3 SUBMITTALS:

Refer to Section 01300 for procedures.

- A. Shop Drawings. Show all details of all ductwork and supports, piping and supports, and equipment pads. Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.
- B. Product Data:
 1. Submit copies of all manufacturer's product data in accordance with Section 01300 simultaneous with all shop drawing submittals.
 2. Product data to include all air conditioning equipment, hangers, fans, ductwork construction, and other standard items as required to complement shop drawings.
 3. Manufacturers and suppliers of equipment shall provide all data necessary for compliance with the State of California Energy Conservation Standards, coordination with other trades and compliance certification for all equipment shall be included in equipment submittals.
 4. For Rooftop Package Units: Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials and electrical characteristics and connection requirements. Provide fan performance with specified operating point clearly labeled. Submit sound power level data for

casing radiation at rated capacity. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.

- C. Record Drawings: Maintain throughout the progress of the work project record drawings in accordance with Section 01720 and submit to the Architect in compliance with the above section. Provide as-built record drawings in Autocad Release 14 or later format for building engineer's use.
- D. Operating Manuals and Maintenance Manuals:
 - 1. Submit copies of all operating instructions and maintenance manuals in accordance with Division 1.
 - 2. Fully instruct Owner's operating personnel and demonstrate performance, operation and maintenance of equipment. Amount of time allocated for said instruction and demonstrations of equipment and systems shall be part of these obligations. Submit a letter to Architect signed by Owner's representative who will operate systems stating that he has been fully instructed by contractor about operation and maintenance of equipment and system.
 - 3. Submit one additional set of approved instructions and one additional set of approved control diagrams suitably framed behind glass for mounting as directed.
- E. Guarantees: In addition to equipment warranties, furnish a written guarantee against defects in materials and workmanship for one year. Guarantee shall include repair of damage to or replacement of any part of equipment or premises caused by leaks or breaks in pipe or equipment provided under this section.

1.4 PRODUCT HANDLING:

- A. Protection: Take all precautions necessary to protect the materials of this section before, during, and after installation.
- B. Replacements: In the event of damage, immediately repair all damaged and defective work to the approval of the architect at no additional cost to Owner.

1.5 JOB CONDITIONS:

- A. Examination of the Site: Examine the site and include all conditions in bid proposal under which work is to be performed.

1.6 MISCELLANEOUS:

- A. Permits and Fees: Arrange, apply and pay for all necessary permits, inspections, examinations and fees or charges required by public authorities having jurisdiction.
- B. Locations and Accessibility: Contractor shall fully inform himself regarding peculiarities and limitations of spaces available for installation of work under this section. Valves, motors controls and other devices requiring service, maintenance and adjustment shall be placed in fully accessible positions and locations. Provide access doors where required in ductwork or construction whether specifically detailed or not, and render all such devices accessible.

- C. Scaffolding: Furnish all scaffolding, rigging and hoisting as required for the proper execution of the work.
- D. Drawings: Drawings indicate desired location and arrangement of piping, equipment and other items, and are to be followed as closely as possible. They do not however, show all offsets or transitions required for the exact installation, provide a complete workable installation. Assume the responsibility for coordinating the work with all other trades. Work specified and not clearly defined by the drawings shall be installed and arranged in a manner satisfactory to Architect. In the event changes in indicated locations and arrangements are deemed necessary by Architect, they shall be made by Contractor without additional charges provided the change is ordered before work is installed and no extra materials are required.

PART 2 - PRODUCTS

2.1 ROOFTOP PACKAGED AIR CONDITIONING UNIT (GAS/ELECTRIC):

A. General:

- 1. Factory assembled, single-piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field start-up.

B. Unit Cabinet:

- 1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a prepainted baked enamel finish on all externally exposed surfaces.
- 2. Evaporator fan compartment interior cabinet surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb. density, flexible aluminum foil faced fiberglass insulation.
- 3. Cabinet panels shall be easily removable for servicing.
- 4. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
- 5. Unit shall have a factory-installed, sloped condensate drain pan made of a non-corrosive material, providing a minimum 3/4-in.-14 NPT. connection with both vertical and horizontal drains, and shall comply with ASHRAE Standard 62.
- 6. Unit shall have a factory-installed filter access panel to provide filter access with tool-less removal.
- 7. All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location on side of unit.
- 8. Panels covering control box indoor fan, indoor fan motor, gas components, and compressors shall have molded composite handles.

C. Fans:

1. Evaporator Fan:

- a. Fan shall be direct or belt driven as shown on the equipment drawings. Belt drive shall include an adjustable-pitch motor pulley.
- b. Fan wheel shall be double-inlet type with forward-curved blades.
- c. Bearings shall be sealed, permanently lubricated ball-bearing type for longer life and lower maintenance.

- 2. Evaporator fan shall be made from steel with a corrosion-resistant finish and shall be dynamically balanced.

3. Condenser fan shall be of the direct-driven (with totally enclosed motors) propeller type and discharge air vertically.
4. Condenser fan shall have aluminum blades riveted to corrosion-resistant steel spiders and shall dynamically balanced.
5. Combustion fan shall be a direct drive, single inlet, forward curved centrifugal type.

D. Compressor(s):

1. Fully hermetic type, internally protected scroll-type.
2. Factory mounted on rubber grommets and internally spring mounted for vibration isolation.
3. On independent circuits.

E. Coils:

1. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
2. Dual compressor models shall have face-split type evaporator coil (circuit no. 1 on bottom).

F. Refrigerant Components:

Refrigerant circuit components shall include:

1. Thermostatic expansion valve .
2. Refrigerant filter drier.
3. Service gage connections on suction, discharge, and liquid lines.

G. Filter Section:

1. Standard filter section shall consist of factory-installed, low velocity, throwaway 2-in. thick fiberglass filters of commercially available sizes.
2. Filter face velocity shall not exceed 320 fpm at nominal airflows.
3. Filter section should use only one size filter.

H. Controls and Safeties:

1. Unit Controls:
Unit shall be complete with self-contained low-voltage control circuit protected by a fuse on the 24-v transformer side (008-014 units have a resettable circuit breaker).
2. Safeties:
 - a. Unit shall incorporate a solid-state compressor protector which provides anti-cycle reset capability at the space thermostat, should any of the following standard safety devices trip and shut off compressor.
 - 1) Compressor overtemperature, overcurrent.
 - 2) Loss-of-charge/low-pressure switch.
 - 3) Freeze-protection thermostat, evaporator coil.
 - 4) High-pressure switch.
 - 5) Automatic reset motor thermal overload protector.
The lockout protection shall be easily disconnected at the control board, if necessary.

I. Electrical Requirements:

All unit power wiring shall enter unit cabinet at a single factory-predrilled location.

J. Motors:

1. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have line break thermal and current overload protection.
2. Evaporator-fan motor shall have permanently lubricated bearings and inherent automatic-reset thermal overload protection. Evaporator motors are designed specifically for Carrier and do *not* have conventional horsepower (HP) ratings listed on the motor nameplate. Motors are designed and qualified in the "air-over" location downstream of the cooling coil and carry a maximum continuous bhp rating that is the maximum application bhp rating for the motor; no "safety factors" above that rating may be applied.
3. Totally enclosed condenser-fan motor shall have permanently lubricated bearings, and inherent automatic-reset thermal overload protection.
4. Induced-draft motor shall have permanently lubricated sealed bearings and inherent automatic-reset thermal overload protection.

K. Roof Curb:

1. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
2. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
3. Shall be welded type or calculated knock-down type conforming with the 2014 CBC.

L. Integrated Economizers:

1. Integrated integral modulating type capable of simultaneous economizer and compressor operation. During economizer operation, only compressor no. 1 on sizes 008-014 will operate.
2. Available as a factory-installed option in vertical supply/return configuration only.
3. Includes all hardware and controls to provide cooling with outdoor air.
4. Equipped with low-leakage dampers, not to exceed 2% leakage at 1 in. wg pressure differential.
5. Capable of introducing up to 100% outdoor air.
6. EconoMi\$er2 shall be equipped with a barometric relief damper.
7. Designed to close damper(s) during loss-of-power situations with emergency power supply (Durablade economizer) or spring return built into motor (EconoMi\$er2).
8. Dry bulb outdoor-air temperature sensor shall be provided as standard. Outdoor air sensor opens at 67 F, closes at 52 F and is non-adjustable. Enthalpy, differential temperature (adjustable), and differential enthalpy control shall be provided as field-installed accessories.
9. Durablade economizer is a guillotine-style damper, and the EconoMi\$er2 is gear-driven parallel blade design.
10. Compressor lockout sensor (opens at 35 F, closes at 50 F).

M. Electronic Programmable Thermostat:

1. Carrier CT855i, T-24 approved capable of using deluxe full-featured electronic thermostat. Shall use built-in compressor cycle delay control for both heating and cooling duty. Capable of working with Carrier direct digital controls. Wi-Fi enabled to communicate to local utility for demand load response.

2.2 EVAPORATIVE COOLERS:

- A. Factory assembled, single-piece cooling unit with both downshot and side discharge configuration as indicated on the plans. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up. The bottom pan shall be 1-piece construction, the unit exterior shall be polyester powder-coated cabinet made of heavy-gaged galvanized steel. The media shall be aspen pad made from shredded aspen wood held together with a plastic netting. Fan shall be machine balanced

and rated for scheduled CFM with associated TEFC motor. Pump shall be able to be run dry without burning out the pump motor. The unit shall be made in the USA.

2.3 SPLIT SYSTEM AIR CONDITIONING UNIT (Ductless Split):

A. General:

1. The Air ConMitsubishi Electric split system with Variable Speed Inverter Compressor technology. The system shall consist of a horizontal discharge, single phase outdoor unit, a matched capacity indoor section that shall be equipped with a wired wall mounted, wireless wall mounted and/or wireless hand held remote controller.

B. Unit Cabinet:

1. The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a Munsell 3Y 7.8/1.1 finish.

C. Fan:

1. Models PUY-A18/24/30/36NHA4 shall be furnished with a single DC fan motor.
2. The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.
3. The fan motor shall be mounted for quiet operation.
4. The fan shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have horizontal discharge airflow.

D. Refrigerant

- a. R410A refrigerant shall be required for PUMY-P-NHMU outdoor unit systems.

E. Coil:

1. The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
2. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor controlled step motor.coil shall be of nonferrous construction with lanced or corrugated fins on copper tubing.
3. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

F. Compressor:

1. The compressor for models PUY-A12/18/24/30/36NHA4 shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology. The compressor for model

PUY-A42NHA4 shall be a Frame Compliant Scroll compressor with Variable Speed Inverter Drive Technology.

2. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings.
3. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
4. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.e mounted to avoid the transmission of vibration.

G. Electrical:

1. The electrical power of the unit shall be 208volts or 230 volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
2. The outdoor unit shall be controlled by integral microprocessors.
3. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair, non-polar shielded cable to provide total integration of the system.

H. General:

1. The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit, in conjunction with the wired wall-mounted controller, wireless wall-mounted controller or wireless handheld controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

I. Unit Cabinet:

1. The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter. Cabinet color shall be white – Munsell 1.0Y 9.2/0.2. The unit shall be wall mounted by means of a factory supplied, pre-drilled, mounting plate.

J. Fan:

1. The indoor unit fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of three (3) speeds: Low, Mid, and Hi and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

K. Filter:

1. Return air shall be filtered by means of an easily removable washable filter.

L. Coil:

1. The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. An optional drain pan level switch (DPLS1), designed to connect to the control board, shall be provided if required, and installed on the condensate pan to prevent condensate from overflowing. The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing.

M. Electrical:

1. The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the Mitsubishi Electric A-Control system. For A-Control, a three (3) conductor AWG-14 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.

N. Control:

1. The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN152 and a 12 VDC output.

2.4 BUILDING AND TOILET EXHAUST FANS:

- A. Cook Model CPV-SWSI of size and capacity indicated. Fan shall be AMCA rated, UL listed and manufactured at an ISO 9001 certified facility. Fan shall be Steel Housing, bolted and welded construction with minimum 12 gage steel side panels. The fan shall be roof mounted, belt-driven, CCW rotation, centrifugal blower, statically and dynamically balanced. Unit shall come with: Aluminum wheel, belt drive motor, Premium efficiency motor, Weatherhood, and outlet guard, arrangement 10 and shall be THD or upblast as scheduled.
- B. Cook Model ACEB of size and capacity indicated. Fan shall be AMCA rated, UL listed and manufactured at an ISO 9001 certified facility. Fan shall have aluminum housing, bolted and welded construction with minimum 16 gage marine aluminum structural components. The fan shall be roof mounted, belt-driven, centrifugal backward inclined blower, statically and dynamically balanced per AMCA Standard 204. Unit shall come with: Aluminum wheel, belt drive heavy duty motor. Belts and drives shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, j-keyed and securely attached to the wheel and motor shafts. Bearings shall be heavy duty with a minimum L50 life.
- C. Cook Model GC of size and capacity indicated. Fan shall be AMCA rated, UL listed and manufactured at an ISO 9001 certified facility. Fan shall have minimum 20 gage steel housing with acoustical insulation. The blower wheel shall be centrifugal forward curved type, constructed of galvanized steel. Motor shall be ODP with permanently sealed bearings, built in thermal overload protection and disconnect plug.

- D. Cook Model EWB of size and capacity indicated. Fan shall be AMCA rated, UL listed and manufactured at an ISO 9001 certified facility. Propeller fan shall be aluminum airfoil blades with a cast aluminum hub. The hub shall be keyed and locked to the shaft utilizing two set screws or a taper lock bushing. The motor bearings and drives shall be mounted on a 14-gauge steel power assembly. All ungalvanized steel fan components shall be Lorenized with an electrostatically applied baked polyester powder coating. Optional 120V motorized shutter with shutter guard, wall collar, wire guard shall be placed on the motor side.

2.5 GRAVITY INTAKE VENTILATOR:

- A. Cook Model TRE of size and capacity indicated. Unit shall be manufactured of 0.081 gauge extruded aluminum tiers welded to a minimum 8 gauge aluminum support structure. The aluminum hood shall be constructed of minimum 0.063 aluminum and provided with a layer of anti-condensate coating. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. Birdscreen constructed of ½" galvanized mesh shall be mounted across the relief opening.

2.6 GAS INFRARED RADIANT HEATER:

- A. Roberts Gordon of size and capacity indicated. Unit shall have hot rolled aluminized tube with high efficiency aluminum reflector. Flue shall be ducted to outdoors while combustion air shall be taken from inside the building. Provide with hanging kit, angled reflector, T-24 thermostat hard coded for 55F and spring wound timer.

2.7 ELECTRIC BASEBOARD HEATER:

- A. Markel of size and capacity indicated. Unit shall be brown with stainless steel heating element and aluminum fins. Housing shall be 12 gauge heavy duty extruded aluminum, powder coated. Furnish with single pole, in-built thermostat #3900T1C mounted in J-box enclosures for tamper proof operation.

2.8 DIFFUSERS, REGISTERS AND GRILLES:

Air distribution equipment shall be of sizes and capacities indicated.

- A. Colors: Air distribution equipment installed in ceilings shall be furnished in factory finished enamel of color to match tile and open area as selected. Submit paint samples for approval. Typical color is British White unless noted otherwise.
- B. Square Ceiling Diffusers, SA: Krueger series 6500 with perforated face, of size and capacity indicated. Diffusers shall have factory installed curved-blade cores to provide multi-direction blow patterns as required. Mounting shall be adapted to ceiling suspension system. Use panel size 16 x 16 inches or 24 x 24 inches.
 - 1. Supply air shall be introduced into conditioned space in such a manner that conditioned air and room air is rapidly and evenly mixed, resulting in equalization of temperature and draftless air distribution throughout zones of occupancy with temperature differentials up to 25 degrees F for both cooling and heating. Air quantities and throws shall be as indicated.
 - 2. Velocity of moving air below 5 foot level, during cooling cycle, shall not exceed limits of either 50 fpm at 1.5 degrees F below average room temperature or 70

fpm at 1 degree F below average room temperature. During heating cycle, velocity of moving air at the one foot level shall not be less than 10 fpm. Temperature difference at or below the 5 foot level shall not exceed the following: 2 degrees F below average room temperature at 50 fpm, 1 degree F below average room temperature at 70 fpm. Sound pressure level in all octave bands for each diffuser shall not exceed NC 30 noise criteria curve at task level when units operate at designed capacities.

- C. Return and Relief Air Grilles, RA: Krueger series 6690 and 6490 with extruded frame to match ceiling diffusers.
- D. Supply Registers in Hard-Lid Gyp. Bd. Ceilings, SAR: Krueger Series 180 with OBD, Frame 22.
- E. Supply Nozzles in Wall, SA-1: Krueger Series RPN with 70 degree directional rotation, there shall be a felt gasket between the nozzle and the frame of the ball and socket joint to provide a tight air seal. The finish shall be #81 clear Anodized finish.
- F. Duct Mounted Supply Registers, SA-2: Krueger Series DMGDR with OBD.
- G. Supply and Wall Registers, SA-3: Krueger series 5880/5580 with opposed blade volume dampers.
- H. Linear Diffusers, SA-4: Krueger series 1900 with slot size and width as indicated on drawings.
- I. Exhaust and Return Registers in Hard-Lid Gyp. Bd. Ceilings, RAR and EAR: Krueger EGC10 with OBD.
- J. Stainless Steel Exhaust Registers in Hard-Lid Ceilings, EA-1: Krueger 9S80 with Stainless Steel OBD welded to the grille and operable face, 0 degree deflection, 304 Stainless Steel, 3/4" on center blades, stainless steel metal screws. Finish shall be #3 satin polish finish

2.9 DUCTS AND SHEET METAL WORK:

- A. Provide ducts, plenums, access doors, fresh air intakes, and exhausts as indicated and required. All ductwork shall be constructed, erected and tested in accordance with the California Mechanical Code, procedures detailed in the ASHRAE Handbook of Fundamentals. Provide prefabricated spiral lockseam ducts and fittings, flat oval ducts and rectangular ducts of galvanized steel, constructed to pressure rating of External Static Pressure of A/C unit. Carwash exhaust duct serving the tunnel shall be welded stainless steel duct, sloped back to exhaust inlet at 2%.
- B. Final connections to ceiling diffusers shall be made with flexible glass fiber duct. Casco Silent Flex-II. Connections of flexible duct to round ducts shall be made with 1/2 inch wide positive locking steel straps.
- C. All connections to main supply ducts shall be made with low loss fittings.
- D. Flat duct surfaces shall be crimped diagonally regardless of size. Longitudinal joints in all duct sizes may be flat-lock joints. Transverse joints and intermediate bracing shall be constructed of galvanized sheet metal or galvanized structural angles in accordance with requirements of the ASHRAE guide and public authorities having jurisdiction.
- E. Transverse joints on all supply ducts shall be sealed with mastic and tape.

- F. Longitudinal joints on low pressure supply ducts with internal static pressure in excess of 0.75 inches of water pressure shall be sealed with mastic and tape.
- G. Lock joints shall be hammered to make them airtight. Inside of duct shall present a smooth surface to flow of air.
- H. Changes in size of ducts shall increase gradually with a slope of not more than 12 inches in 5 feet where possible, but not more than 12 inches in 3 feet in any event.
- I. Turns shall be made with a throat radius of not less than the duct width.
- J. Horizontal ductwork shall be strongly supported with galvanized hangers in accordance with the requirements of the ASHRAE Guide and public authorities having jurisdiction.
- K. Plenums shall be made of 18 gauge galvanized sheet steel reinforced horizontally on a maximum of 48 inch centers by 1-1/2 x 1-1/4 x 1-1/8 inch galvanized angles and reinforced vertically by 1-1/2 inch standing seams.
- L. Plenum access doors 24 x 54 inch minimum size shall be galvanized sheet steel doors and frames properly reinforced to prevent breathing. Door shall be of same gauge as the duct or casing and shall have 1 inch insulation with galvanized sheet steel on both sides. Each door shall be hung on 5" tee hinges and with one or more catches which are operable from both sides and similar to Ventfabris, Inc. 260 Ventlock latch. Doors shall be hung to open against pressure and shall be fitted with felt to insure airtightness.
- M. Flexible connections for air ducts shall be 16 oz. airtight "Ventglas" noncombustible fabric with fire retardant neoprene coating on outside. Attach to ductwork by lock seam. Install not more than 6 inches long. Provide where required or indicated.
- N. Seal transverse joints on main cold supply air ducts with approved duct sealing compound. Apply additional coats of sealer to make ductwork completely airtight.
- O. Main supply duct shall be constructed to 2" Duct Class with Class A seal (joints, seams and all wall penetrations to be sealed). The allowable leakage shall be per leakage Class 6 for rectangular and Class 3 for oval or round duct, in accordance with SMACNA HVAC Duct Leakage Test Manual.

2.10 TURNING VANES:

- A. Both dimensions less than 48 inches; Duro-dyne vane rails or approved single thickness vanes.
- B. Either dimension greater than 48 inches: Single thickness vanes of approved pattern.
- A. Rectangular smooth radius elbows - provide multiple splitter vanes.

2.11 DAMPERS AND LOUVERS:

- A. Provide balancing volume dampers in each branch duct and in each main duct to provide for complete air balancing. Fit each manual volume damper with bearings and an adjusting device having a locking mechanism. Provide access panels if concealed or inaccessible through ceiling or wall.

- B. Balancing dampers where neither dimension of cut exceeds 17 inches may be job fabricated butterfly type consisting of a blade constructed of 18 gauge galvanized steel securely riveted or welded at its center axis to a square operating rod.
- C. Balancing dampers where either dimension exceeds 18 inches shall be Air Balance AC-116, opposed blade type.
- D. Fire dampers: Fusible link out of airstream type manufactured in accordance with requirements of State Fire Marshall and public authorities having jurisdiction, with permanent labeling identification. Provide suitable access for servicing dampers.
- E. Combination Fire/Smoke Dampers: Ruskin FSD 60, with integral factory wired smoke detector.
- F. Automatic Smoke Dampers: Ruskin CD 60.
- G. Backdraft Dampers: Ruskin BD 6.
- H. Stationary Louvers: Ruskin L6375D.

2.12 DRIFT ELIMINATORS IN CAR WASH EXHAUST DUCT:

- A. Drift Eliminators shall be Brentwood Accupac Crossflow Cellular type : The eliminators shall be constructed entirely of inert polyvinyl chloride (PVC) in easily handled sections. The eliminator design shall incorporate three changes in air direction to assure complete removal of all entrained moisture from the discharge air stream. Maximum drift rate shall be less than 0.002%. Prepare a duct section that houses the drift eliminators sized to be less than 0.15" static pressure drop thru the eliminators.

2.13 INSULATION:

- A. Thermal Duct Insulation: Insulate all concealed main supply air ducts and plenums unless otherwise specified, with J-M Microlite fiberglass duct insulation, foil-faced, 3/4 lb. density, 1-1/2 inch thick insulation wrapped entirely around duct with joints lapped at least 2 inches and secured with 16 gauge galvanized wire on 12 inch centers. Insulation shall cover all surfaces including standing seams.
- B. Exposed Supply Air Ducts: Shall be lined with J-M Linacoustic, 1 inch thick, 1-1/2 lb. density coated fiberglass duct liner complying with NFPA 90-A requirements. The cut liner shall have an air friction correction factor not greater than 1.1 at a velocity of 3000 fpm. Apply insulation to inside of ducts with an approved fire retardant adhesive to provide 100% coverage and a smooth surface. In ducts with one side more than 12 inches, secure insulation with mechanical fasteners in addition to adhesive, spaced at 14-inch centers in both directions.

Mechanical fasteners shall be flush with the liner surface and shall start within 2 inches of the leading edge of each section and within 3 inches of the leading edge of all cross-joints within the duct section. All exposed edges and the leading edge of all cross-joints of the liner shall be heavily coated with an approved fire resistant adhesive. The duct liner shall be cut to assure snug closing corner joints, the black surface of the liner shall

face the air stream, transverse joints shall be neatly butter, and all damaged areas shall be heavily coated with an approved fire resistant adhesive.

- C. Contractor's Option: Concealed main supply air ducts and plenums may be lined in lieu of external wrapping as hereinbefore specified.
- D. Sound Duct Insulation: Where indicated, sound insulate air ducts as hereinbefore specified for exposed cold supply air ducts.

2.14 EQUAL MATERIALS AND SUBSTITUTIONS:

- A. In addition to manufacturers specified, the following shall also be considered equal, providing corresponding models to meet specified requirements. Equivalent substituted equipment named herein shall be submitted to Architect for approval. Submit alternate selection at time of bid listing major equipment.

ITEM	MANUFACTURER
PACKAGE A/C UNITS	York, Trane
GAS VENTS	METALBESTOS
INSULATION	JOHNS MANVILLE, GUSTIN BACON
	FIBERGLAS
DIFFUSERS, REGISTERS, GRILLES	TITUS, PRICE
SUPPLY & EXHAUST FANS	GREENHECK

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS:

- A. Inspection:
 - 1. Prior to commencing work required by this section, inspect the work of other trades and verify that such work has been properly completed and installed to allow for proper installation of all materials and methods required of this section.
 - 2. All heating, ventilation and air conditioning shall be installed in accordance with the requirements of all governing authorities, the original design, and the referenced standards.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Architect.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 EQUIPMENT IDENTIFICATION:

- A. All major equipment shall bear firmly attached metal nameplates which state name of manufacturer, model number and electrical data. An additional permanent label shall be affixed to each equipment which will clearly indicate by number which operating and maintenance manual explains maintenance requirement in detail.
- B. Valve identification:

1. Valve charts: Two typewritten charts not less than 8x10 inches shall be made showing assigned numbers controlled in each system by each valve in mechanical equipment rooms only. Charts shall be mounted behind aluminum framed glass as directed.
 2. Valve tags: Provide tag consisting of 2 inch diameter, 20 gauge, stainless steel or copper disk for each main line shut-off valve or cock. Fasten tags in place with continuous steel ring or chain around stem of valves and around pipe for cock. Two inch letters and figures stenciled in contrasting colors on pipe or pipe coverings may be substituted for tags on OS&Y valves. Disks shall be stamped with a number corresponding to identification (or location) number shown on valve chart and with service designation with 1/4 inch high letters.
- C. Pipe Identification: Mark each individual pipe in mechanical equipment rooms only for quick and easy identification with Identobands, aluminum with enamel finish, 1-1/2 inches wide, installed as recommended by manufacturer after completion of piping and finish painting. Unless otherwise specified, coding shall conform to "Scheme for the Identification of Piping Systems" (ANSI A13.1-1956). Color scheme shall be approved. Base color for markers shall be as follows:
1. Space Heating hot water: Orange
 2. Chilled Water: Green
 3. Condenser Water: Green
 4. Closed Circuit Cooler Water: Green
 5. Make-up water: Green
 6. Refrigerant Piping: Green

3.3 SAFETY PROVISIONS:

Equipment and piping with temperatures above 140 degrees F or temperatures below 25 degrees F, located as to endanger personnel or create a fire hazard, shall be properly guarded or covered with insulation of type specified. Bolts, gears, chains, pulleys, couplings, projecting set screws, keys and other rotating or reciprocating parts shall be enclosed or properly guarded. Provide guard rails, etc., required for safe operation and maintenance of equipment.

3.4 INITIAL LUBRICATION:

Before operating any mechanical systems, equipment bearings shall be lubricated and bolts, pulleys, and other moving parts checked for alignment and tolerances in accordance with manufacturer's operating instruction. Piping and liquid systems shall be flushed out and filled with operating fluids. After tests, valves and other parts of work shall be adjusted for quiet operation. Strainers shall be cleaned out by removing and washing basket or screen. Vibrations and noise shall be suppressed.

3.5 CLEANING OF EQUIPMENT, MATERIALS AND PREMISES:

Refer to section "Cleanup and Disposal." Clean equipment and materials thoroughly. Leave surfaces to be painted smooth, clean, and ready for painters. Clean entire premise of unused materials, rubbish, debris, grease spots and dirt left by subcontractors. Remove, clean and replace pipeline strainers after systems have been in operation for a period of 30 calendar days.

3.6 HANGERS AND SUPPORTS:

- A. Hold horizontal pipe runs firmly in place using approved steel and iron hangers, supports, and/or pipe rests, unless otherwise indicated. Suspend hanger rods from concrete inserts or from approved brackets, clamps or clips. Hang pipes individually or in groups if supporting structure is adequate to support weight of piping and fluid. Except for buried piping, hang or support pipe runs so they may expand or contract freely without strain to pipe or equipment.
- B. Horizontal Steel Piping: Provide hangers or supports every 10 feet except every 8 feet for piping under 1 inch in diameter, unless otherwise specified.
- C. Horizontal Copper Tubing: For 2 inch diameter and over, provide hangers, every 10 feet, for 1-1/2 inch diameter and smaller, every 6 feet.
- D. Vertical Piping: Support at every floor with wrought iron pipe clamps.
- E. Branches: Provide separate hangers or supports for branch lines 6 feet or more in length.

3.7 EQUIPMENT AND MATERIALS:

Install per manufacturer's recommendations.

3.8 ACCESSIBILITY:

Install work readily accessible for normal operation, reading of instruments, adjustment, service, inspection and repair. Provide access panels where indicated and required. Access panels shall be the responsibility of the respective subcontractor.

3.9 EXCAVATION AND BACKFILL:

Perform excavation and backfilling required for mechanical work under this division unless otherwise specified. Conform to requirements of Division 2 and of public authorities having jurisdiction.

3.10 EXPANSION AND CONTRACTION:

Install piping subject to expansion and contraction with expansion loops made up of bends or fittings, expansion joints, swing joints, or other approved methods or devices. Branch lines from main subject to expansion and contraction shall have a swing joint at point of connection with the main. Risers which pass through one or more floors shall have swing joints at their base. Anchor lines subject to expansion and contraction by approved methods to restrict movement.

3.11 SYSTEM BALANCING:

- A. Balancing data shall be submitted for air flow at each outlet, outside air, return air, total supply air, fan rpm, fan pressures, water quantities and temperatures and any other data deemed necessary to show that proper adjustments have been made. An independent

balancing company certified and in good standing with the Associated Air Balance Council (AABC) shall be retained to balance all systems. All costs for this service shall be paid by Contractor.

- B. Tests shall be witnessed by Owner's representative and submittal data signed by Owner's representative before final inspection.
- C. Air balance subcontractor shall verify that dampers have been installed for adequate air balancing and that air loss in ductwork will not prevail. Duct joints shall be repaired by contractor.
- D. Balancing Work Included:
 - 1. Complete testing and balancing of all systems, distribution piping, condenser water, chilled water and heating hot water flows, air testing and balancing of all exhaust systems, air handling units, and air distribution equipment complete as herein specified. Allow for 2 sheave changes for each belt drive fan to achieve required CFM.
 - 2. System balancing shall be performed by independent agency certified by AABC. Submit proof of qualifications for each Specialty Contractor certified to perform such services.
 - 3. All balancing shall be to the satisfaction of the Architect. Should the Contractor refuse or neglect to balance the system to the Architect's satisfaction, such balancing shall be made by an independent agency at the Contractor's expense.
 - 4. The Contractor shall make drive changes, install additional dampers, vanes, grille baffles, or other items, as may be required on the job, to balance the system to the Architect's satisfaction.
- E. Verification of Conditions: Prior to testing and balancing, inspect equipment and materials and arrange with Contractor for satisfactory correction of all defects in workmanship and/or material that could disaffect the work specified herein.
- F. Protection: As specified hereinbefore.
- G. Agency: All systems balancing shall be supervised by an Independent Agency which specializes in balancing and testing of mechanical systems, hereinafter referred to as the Agency.
- H. System operation: Contractor shall put all parts of systems in full operation and shall continue the operation of same during each working day of testing and balancing.
- I. Submittals: Within 90 days after the start of construction, submit a complete testing and balancing procedure showing all test equipment that will be used, testing procedures, test data sheets, systems schematics, and point of testing.
 - 1. Test Data: Submit 10 copies of test data to Architect on completion of work under this Section.
 - 2. Certificate: Agency shall certify in writing that system has been adjusted and balanced and design conditions have been attained in all areas of building.
- J. Instruments: Instruments used by Contractor shall be accurately calibrated and maintained in good working order. Instruments shall have certified by the manufacturer or an approved test laboratory within one year of the testing date; submit this certificate to Architect. Test instruments furnished by Contractor for delivery to Owner may be used to perform part of the system balancing.

- K. Air Distribution Testing and Balancing:
1. Make pitot tube transverse of main supply ducts and obtain design CFM at fans at simulated full load conditions.
 2. Pressure test all ductwork in accordance with SMACNA Duct Leakage Test Manual. Test at 2" W.G.
 3. Test and adjust system for design return and exhaust air CFM.
 4. Test and adjust system for design CFM outside air.
 5. Adjust all main supply and return air duct to proper design CFM.
 6. Adjust all zones to proper static pressure, design minimum and maximum CFM and air temperature.
 7. Test and adjust each diffuser, grille and register to within +/- 10% of design requirement.
 8. Each grille, diffusers, and register shall be identified as to location and area.
 9. Size, type and manufacturer of diffusers, grilles, registers and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations.
 10. Readings and tests of diffusers, grilles and registers shall include the required FPM velocity and test result velocity, required CFM, and test result CFM after adjustment.
 11. In cooperation with the control manufacturer's representative, the setting adjustment of automatically operated controls to operate as specified, indicated and/or noted.
 12. All diffusers, registers and grilles and all equipment shall be adjusted to maintain the design and conditions at design loads.
- L. Air Moving Equipment.
1. Manufacturer
 2. Total CFM (Fan & Outlet)
 3. RA CFM
 4. OA CFM
 5. Inlet and outlet Static Pressures
 6. Fan RPM
 7. Motor Manufacturer, HP & BHP
 8. Phase, Voltage, Amperage
 9. Motor RPM
- M. Pumping Equipment:
1. Manufacturer, Size, Impeller
 2. GPM, FT HD, Inlet & Outlet Pressures
 3. Motor Manufacturer, HP & BHP
 4. Phase, Voltage, Amperage
 5. Motor RPM
- O. Heating and Cooling Coils:
1. Air CFM & PD, Temperature In & Out (WB & DB)
 2. GPM, Water Temperature In & Out, Water PD
- P. Coordinate tests with the manufacturer of each equipment.
- Q. Witness: Notify Architect in writing two weeks prior to testing and balancing of all major equipment in order to arrange that Architect's representatives will witness the tests.

3.12 INSTALLATION:

Packaged A/C units, and other equipment shall be installed on concrete or wood bases and bolted to structures as indicated.

3.13 DISCHARGE PIPING:

Valves shall be extended down from automatic air vents to nearest floor sink.

3.14 DRAIN LINES:

Drain lines from evaporative coolers and AC units shall be extended down to nearest floor sink.

3.14 AIR DISTRIBUTION EQUIPMENT LOCATIONS:

Air distribution equipment locations shall be coordinated with architectural drawings.

3.15 TURNING VANES:

Turning vanes shall be installed in all right angle sharp turns in ducts.

3.16 SOUND INSULATION:

Where indicated, specified duct dimensions are net clear dimensions, i.e., clear dimensions, after sound insulation has been installed.

3.17 DUCTWORK:

Ductwork connected to louvered openings shall be adapted to size of these openings.

3.18 CONNECTIONS:

Connections between two dissimilar metal pipes shall be made with dielectric unions.

END OF SECTION 15050

SECTION 15440 - PLUMBING**PART 1 – GENERAL****1.1 GENERAL CONDITIONS**

The General Conditions, Supplementary Conditions and Division 1, are a part of this section and the contract for this work and shall apply to this section as fully as if repeated herein.

1.2 SCOPE OF WORK

Furnish all labor, materials, equipment, appliances and necessary incidentals for the complete installation of all plumbing as shown on the drawings and as specified herein.

A. Work Specified in this Section

1. Sanitary soil, waste and vent system.
2. Roof drainage system.
3. Domestic hot and cold water systems.
4. Gas system.
5. Floor sinks and floor drains.
6. Domestic water heaters.
7. Furnish and set all sleeves for pipes passing through walls and floors.
8. Connections to sanitary sewer, water and gas mains.
9. Pipe covering, insulation and wrapping.
10. Excavation and backfill.
11. Rough-in and final connections to air conditioning equipment of gas and water, and condensate drains.
12. Rough-in and final connections to fixtures and equipment furnished under other sections of the specifications or by the Owner.
13. All plumbing fixtures, water heaters, valves, hot water circulating pump, and other miscellaneous items or equipment required for a complete installation.
14. Safing of all penetrations through fire walls and floors.
15. Water for construction and temporary connections.
16. Cathodic protection for underground steel or ferrous piping.

B. Related Work in Other Sections

1. Temporary facilities as specified in Section 01500.
2. Cutting and patching as specified in Section 01045.
3. Concrete work as specified in Division 3; however, furnish templates for spacing and size of concrete pads and anchor bolts for equipment under plumbing.
4. Electrical work as follows will be provided under Division 26:
 - a. Conduit and wiring as indicated on the drawings and as required.

1.3 QUALITY ASSURANCE**A. Codes and Standards**

1. All items indicated on site, architectural or mechanical drawings are to be provided complete from point of connection to finished fixture in conformance with all governing authority requirements. Nothing in these drawings or specifications shall be construed to permit work in violation of governing codes.
 2. In addition to the requirements of all governing codes, ordinances and agencies, conform to the requirements of the following codes and standards:
 - a. California Building Code, 2013 Edition.
 - b. California Plumbing Code, 2013 Edition.
 - c. City of Los Angeles DWP requirements.
 - d. State Fire Marshall.
 - e. State Health Department requirements.
 - f. All requirements of Federal/OSHA.
 - g. California Administrative Codes.
 - h. All other regulatory agencies having jurisdiction over this work.
- B. Guarantees: Furnish a written guarantee form required under Division 1, against defects in materials and workmanship for one year. Guarantee shall include repair of damage to, or replacement (if so required) of any part of premises caused by water, oil, or gas leaks or breaks in pipe, fixtures or equipment provided under this section.

1.4 SUBMITTALS

- A. Manufacturer's Literature: Within 35 days after award of contract and before any of the materials of this section are delivered to the job site, submit seven complete brochures of all materials and equipment, per Division 1 of these specifications.
- B. Other Submittals
 1. Shop Drawings.
 2. Sterilization test report.
 3. Test data.
- C. Operation and Maintenance Instructions: Deliver to Architect two complete sets in bound booklet form of written operating and maintenance instructions and brochures for equipment specified in this section. Fully instruct Owner's operating personnel and demonstrate performance, operation and maintenance of equipment. Amount of time allocated for said instruction and demonstrations of equipment and systems shall be part of these obligations. One additional set of approved instructions shall be suitably framed behind glass and mounted as directed.
- D. Record Drawings: Comply with requirements of Division 1. Keep an accurate dimensioned record of as-built locations and elevations, as referred to approved base datum, of buried concealed lines, manholes, cleanouts, valves, plugged tees, capped ends, and of work which is installed different from that indicated.

1.5 PRODUCT HANDLING

- A. Protection: Take all precautions necessary to protect the materials of this section before, during, and after installation.
- B. Replacements: In the event of damage, immediately repair all damaged and defective work to the approval of the Architect at no additional cost to the Owner.

1.6 MISCELLANEOUS

- A. Examination of the Site: Exercise care in examining the site and coordinate all work indicated on the drawings with existing conditions. Report to Architect in writing conditions that will prevent proper provisions of this work. Verify depth and location of service lines with servicing companies having jurisdiction before excavating. By submission of the bid, the Contractor warrants that he has familiarized himself with the existing conditions and will perform all work as required for hookup and as required by the contract documents at no additional cost to the Owner.
- B. Permits and Fees: Arrange and pay for all permits, inspections and fees required by all governing agencies. Deliver all certificates to Owner through the Architect.
- C. Service Connections: Make all necessary arrangements with applicable utility company for connection to existing service lines. Pay all fees associated with work including meters and hookup charges. Utility assessment fees, if any, will be paid by the Owner and are not part of this contract.
- D. Drawings: Coordinate all space requirements with other trades. Drawings indicate desired location and arrangement of piping, equipment, and other items and are to be followed as closely as possible.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe Sleeves and Wrapping: Provide polished chromium plate and brass set screw flanges where plumbing pipes pass through walls, floors, ceilings, and partitions in finished portions of building, including flanges on pipes at fixtures. All sleeves in concealed and exterior walls shall be 20 gal. galvanized iron one inch o.d. larger than the pipe, caulked if below grade in a moisture-proof manner. All pipes penetrating through fire walls and floors shall be properly safed with Dow Corning 3-6548 Silicone RTV foam. Install per manufacturer's directions.
- B. Pipe Identification
 - 1. Piping identification per ANSI and OSHA standards: Each individual pipeline shall be marked for quick and easy identification as to content and character of material carried in the pipes by Seton SNA or STR markers.
 - 2. Markers shall be installed and spaced at not more than 8 ft. intervals and so located that markers shall be visible where piping system is exposed.
 - a. One marker shall be installed at each side of valves, special fittings and at branch take-off. In furred spaces install one band 2 ft. above floor and 19 in. below ceiling line.
 - b. Furnish two identification charts complete with glass and frame showing list of materials carried in the piping system, classified by nature of its contents and respective identifying colors.
 - 3. Color scheme shall be approved. Base color for markers shall be as follows:

Domestic hot water	-	Yellow
Domestic cold water	-	Green
Fuel gas	-	Yellow
Sanitary sewer	-	Green

- Sanitary vent - Green
- Industrial cold water - Green
- Storm drains - Green

- C. Materials: Materials when not otherwise definitely specified shall conform to the applicable ASTM, ASME, AGA, and ASA standards.
- D. Equal Materials and Substitutions: In addition to manufacturers specified, the following shall also be considered equal, provided corresponding models meet specified requirements. Equivalent substituted equipment named herein shall be submitted to Architect for approval. Submit alternate selections at time of bid, listing major equipment.

<u>ITEM</u>	<u>MANUFACTURER</u>
Strainers:	Walworth, Bailey, Mueller
Solders:	Handy-Harman, Lucas, Milhaupt
Cleanouts:	Zurn
Valves:	Walworth, Milwaukee
Pipe Hangers & Supports:	Grinnell, Fee & Mason, B-Line
Access Panels:	Milcor
Gas Vents:	Metalbestos, Amerivent
Insulation:	Manville, Owens-Corning, Fiberglas
Flush Valve:	Zurn
Plumbing Fixtures:	Crane
Toilet Seats:	Church, Beneke
Electric Water Coolers:	Sunroc, Haws
Drains & Floor Sinks:	Zurn
Backflow Preventers:	Neptune, Hersey
Water Pressure Reducing Valves:	Bailey
Pressure Gauges:	Marsh, Marshalltown, Trerice
Water Heaters:	American, State, Lochinvar
Soil Pipe:	Tyler, Universal

2.2 PIPE AND FITTING SCHEDULE

- A. Soils and storm drain lines 5 ft. from building: Vitriified clay pipe and fittings or service weight no-hub cast-iron pipe and fittings CISPI-301 or ABS plastic pipe. Install in accordance with authorities having jurisdiction.
- B. Soil, waste, vent and storm drain piping and to 5 ft. outside building: Service weight no-hub cast-iron pipe and fittings CISPI-301 or ABS plastic pipe.
- C. Domestic hot and cold water piping above ground: Type L hard-drawn copper tube, ASTM B88, and wrought copper fittings, ANSI B16.22.
- D. Domestic cold water piping below ground and outside the building
 - 1. 3 in. and smaller: Type K hard-drawn copper tube, ASTM B88, and wrought copper fittings ANSI B16.22, solder joint type (refer to paragraph "Pipe Wrapping" herein).
 - 2. 4 in. and larger: PVC Schedule 80 plastic piping.
- E. Indirect and Condensate Drains: Type M copper tube, ASTM B88 and wrought copper fittings, ANSI B16.22, solder joint type.

F. Gas Piping

1. 2 in. and smaller above ground: Schedule 40 black steel pipe, ASTM A-135, A-795, with Class 150 WOG black banded malleable iron screwed fittings.
2. 2-1/2 in. and larger above ground: Schedule 40 black steel pipe, ASTM A-135, A-795, with schedule 40 butt welded fittings.
3. Below ground: PLEXCO PE2406 polyethylene piping systems with electric fusion socket fusion joints. Provide #12 electric tracer copper wire, spiral wrapped around pipe. Backfill with clean sand 4" around pipe. Installation shall be in accordance with manufacturer's direction and authorities having jurisdiction.

2.3 MATERIALS FOR JOINTS, FITTINGS AND VALVES

A. Soil, Waste, Vent and Storm Drain Cast-Iron or ABS Pipe

1. "No-Hub" couplings as approved by the cast-iron soil pipe foundation, CISPI-310-85.
2. ABS piping with solvent welded fittings.

B. Solder and Flux

1. Water Piping: Equivalent to Harris "Bridgit" lead-free brazing alloy. 95-5 solders are not approved.
2. Copper Indirect and Condensate Drainage Piping: Lead-free solder with non-corrosive paste flux.

C. Welded Joints: Welding shall be performed only by qualified welders, and shall comply with ASME Boiler Construction Code, ANSI Code for pressure piping, and state requirements.

D. Unions and Gaskets

1. 2 in. and under for steel pipe: Screwed malleable-iron ground joint, Class 150 WOG, with brass-to-iron seat, galvanized or black to suit service.
2. 2-1/2 in. and larger for steel pipe: Cast-iron flanged gasket type, conforming to ANSI B16.1, galvanized or black to suit service, or 150 lb. forged steel slip-on flanges.
3. Unions for copper tubing: Cast bronze, ground joint pattern, soldered joint connection, ASTM B62 and ANSI B16.18.
4. Dielectric Unions: EpcO, complete with isolators and gaskets of same size as pipe, galvanized or black to suit service.
5. Dielectric Flanges: F.H. Maloney Co., Type E flanges for cathodic insulation.
6. Gaskets: 1/16 in. Garlock #17022.

E. Strainers: Y-type with semi-steel body and stainless steel screen with perforations suitable for service requirements, or same size as pipeline in which installed. Provide gate valve with hose connection at each strainer blow-off.

1. 2-1/2 in. and smaller: Bailey 100-A series, 125 lb. or 250 lb., screwed ends with screwed gasketed cap.
2. 3 in. and larger: Bailey 100-A series, 125 lb. or 250 lb., flanged ends and bolted gasket cap.

F. Valves: Valves shall be of same manufacturer, or following numbers or equivalent by comparator chart of approved manufacturer. Provide adaptors for valves in copper tubing where necessary. All domestic water valves, two (2) in. and smaller, shall be ball valves.

1. Eccentric valves, 2 in. and smaller, gas: DeZurik #425 valve with RS49, plug seals, iron body, screwed or flanged, U.L. listed.
2. Gate valves, 2-1/2 in. and larger, domestic water: 200 psi WOG, solid wedge disc, union bonnet, rising stem, flanged.

Grinnell	6020A
Nibco	F-617-0
Crane	465 1/2
Stockham	G-623

3. Partition stop valves: T&S B415, loose-key type with wall flange.
4. Ball valves, domestic water: Bronze, fullport, class 150, threaded.

Grinnell	3750 or 171N
Nibco	T-585
Jamesbury	300

Note: Flanged iron body valves or equipment used in copper piping systems shall be installed with Maloney Flange and Bolts insulating kits.

G. Check Valves

1. Horizontal swing:

- a. 2 in. and smaller (200 psi WOG), bronze screwed cap, swing.

	<u>Threaded</u>	<u>Solder</u>
Grinnell	3300	3300SJ
Nibco	T-413(BWY)	S-413(BWY)
Crane	37	1342
Stockham	320	B-309

- b. 2-1/2 in. and larger (200 psi WOG), iron body, bronze trim, screwed cap, swing, Y-pattern, regrinding, flanged.

Grinnell	6300A
Nibco	F-918-B
Crane	373
Stockham	G-931

H. Pressure Reducing Valves

1. 1 in. and smaller: Cla-Val #990.
2. 1-1/4 in. and larger: Cla-Val #90-01.

2.4 BACKFLOW PREVENTERS

- A. Reduced Pressure Type: Watts model RP, or Pipe relief to floor sink.

2.5 HOSE BIBBS

- A. HB-1: Equivalent to Woodford 24P-3/4, polished chrome-plated wall faucet with vacuum breaker and loose tee key.
- B. HB-2: Equivalent to Woodford Y24, chrome-plated yard type with vacuum breaker and loose tee key.
- C. HB-3: Equivalent to Woodford B75, wall hydrant with vacuum breaker.

2.6 PIPE HANGERS

- A. Hangers shall be supplied with factory installed isolation and di-chromate finish.
 - 1. 2 in. and smaller: Grinnell F69.
 - 2. 2-1/2 in. and larger: Grinnell F65.
 - 3. Concrete inserts: Grinnell 281 and 282.
 - 4. Riser clamps for copper piping: Grinnell 261P, plastic coated.
 - 5. Riser clamps for other piping: Grinnell 261.
- B. Hanger rods shall conform to the following table:

Pipe size 2 inches and smaller:	3/8 inch rods
Pipe size 2-1/2 inches and 3 inches:	1/2 inch rods
Pipe size 3 inches and larger:	5/8 inch rods

2.7 ROOF FLASHING

- A. Sanitary Vent Flashings: Semco 1100-3 or 1100-5, with one-piece lead flashing and counterflashing sleeve.
- B. Other Pipe Through Roof Flashing: Semco 1100-2 or 1100-4, one-piece 4 lb. lead flashing and counterflashing sleeve.

2.8 PIPE SLEEVES

At concrete walls or floors, Adjust-to-Crete, Paramount, Hole-Out or Sperzel Cretesleeve. Floor sleeves shall extend to top of concrete curbs for piping rising through floors. Wall sleeves shall be flush with finished surface. Sleeves shall be sized to allow 1/2 in. clearance around pipe insulation. Insulation and covering shall be continuous through wall and floor sleeves.

2.9 ACCESS PANELS

- A. Access Panels in Plaster Walls and Ceilings: Karp #DSC214PL, Elmdor PW, 24x24 in. with metal access door and frame, prime coated steel and painted to match adjacent surfaces. For fire rated areas use Karp #KRP-150 FR 1-1/2 hour "B" Label access panels, U.L. listed.

- B. Access Panels in Acoustic Tile Ceilings: Karp #DSC-210, Elmdor AT, 24x24 in. with metal access door and frame, 24x24 in. minimum size, prime coated steel, recessed to accept standard tile in full opening door.
- C. Access Panels in Ceramic Tile Walls: Elmdor DW-SS, Smith 4730, chrome-plated cover and frame of suitable size for purpose intended, but not less than 8x8 in. size. For fire rated areas use Elmdor FR 1 - 1-1/2 hour "B" Label access panels, U.L. listed.

2.10 CLEANOUTS

For cast-iron soil pipe, iron body with extra heavy bronze plugs screwed into caulking ferrules; for steel pipe, extra heavy bronze plugs; and for vitrified clay pipe, vitrified clay plugs. Where cleanouts occur in finished interior walls, provide access panels, plates, and frames for flush mounting. Exposed parts of floor cleanouts shall have adjustable top. All cleanouts and cleanout plugs shall be accessible. Cleanout shall be the following:

- A. In finished floors: Cast-iron with polished nickel bronze round top, non-skid diamond tread set flush with the floor. Provide flashing flange when used with waterproofing membrane.
 - Smith - 4023
 - Wade - W-6000
 - Zurn - ZN-1420-2
 - Josam - 56010 (add -41 when needed)
- B. In mechanical equipment areas: Cast-iron with heavy cast-iron round top, non-skid diamond tread set flush with the floor. Provide flashing flange when used with waterproofing membrane.
 - Smith - 4223
 - Wade - W-6000
 - Zurn - Z-1420-25
 - Josam - 56070 (Add -41 when needed)
- C. In walls: Cleanout tee with squared polished nickel bronze access plate with vandalproof screws and frames. Opening 8x8 in. minimum.
 - Smith - 4558-U
 - Wade - W-8460-S
 - Zurn - ZN-1445-3
 - Josam - 58770-15
- D. In exterior grades: Cast-iron body, vandalproof cover, non-skid diamond tread, set flush with grade or finished surface. In non-surfaced area, they shall be cast in a concrete block 14x14x6 in. deep.
 - Smith - 4020-U
 - Wade - W-8300MF
 - Zurn - ZN-1460-15-W/Z-1450-8
 - Josam - 58680-15

2.11 SHOCK ABSORBERS

Precision Plumbing Products (PPP) shock absorbers installed as indicated or as recommended by PDI pamphlet WWH-201. Provide access panel for a single multiple fixture installation (not of flush valve type). In no case shall a fixture be installed without shock protection.

2.12 PRESSURE TEMPERATURE RELIEF VALVE

Provide domestic water heater with ASME rated pressure/temperature relief valve set to relieve at 125 psi pressure and at 188 degrees to 208 degrees F temperature range.

2.13 PRESSURE GAUGES

Potter-Roemer 6240-U.L. - F.M. 0-300 psi range, complete with 3-1/2 in. diameter dial and gauge cock. Install pressure gauges where indicated and as required.

2.14 INSULATION

- A. All pipe insulation shall comply with the State of California Energy Conservation Standards. Insulation thicknesses indicated are based on insulation having thermal resistances in the range of R-4.0 to R-4.6 per inch of thickness on a flat surface at a mean temperature of 75 degrees F. Thicknesses indicated are minimum and shall be increased proportionately for materials having R values less than 4.0 per inch of thickness or may be reduced for materials having R values greater than 4.6 per inch thickness. Install pipe insulation after piping is installed, tested and approved and is in clean, dry condition. Firmly butt insulation joints.
- B. Insulate all hot water and interior condensate drain piping with glass fiber pipe insulation with factory applied white jacket, J-M Micro-Lok 650 AP, 1 in. thick for pipe sizes of 1/2 in. to 1 in., and 1-1/2 in. thick for pipe sizes to 1-1/4 in. and larger. Insulate fittings and valves with preformed insulation with PVC premolded one piece fitting cover, J.M. Zeston cover. Adhere longitudinal laps and butts of strips of jacket with factory applied pressure sensitive tape system, J-M AP-T. Flanges and unions shall not be covered.
- C. Insulate all piping under lavatories accessible to the physically handicapped with Plumberex Specialty Products (619-322-1772) hot water supply and 'P' trap prefabricated insulation.

2.15 PLUMBING FIXTURES

- A. General: Plumbing fixtures trim and exposed supplies and wastes shall be brass with polished chrome-plated finish. Provide individual loose key stops or, if so specified, screw driver stops for supplies and, unless integral with valves or faucets, mount under fixture. Separately trap all wastes. Provide exposed supplies and wastes to wall with polished chrome-plated cast brass wall escutcheons. All lavatories shall have 1-1/2 in. 17 gauge chrome-plated cast brass P-traps. All plumbing fixtures shall be white, unless otherwise noted.
- B. Wall-Hung Fixtures: Fixtures specified with hangers or supporting arms shall have hangers or arms securely mounted on a 1/4 in. thick by 6 in. wide steel wall plate which extends at least one stud beyond first and last fixture mounting points, or a total of three studs minimum. Attach wall plate to each structural stud it crosses by tack welding each side of stud flange at top and bottom of plate. Fixture or supporting arms shall be securely and firmly attached to steel wall plate in accordance with manufacturer's instructions. If structural studs are not being installed behind wall-hung fixtures, plumbing contractor shall notify Architect and Mechanical Engineer immediately.

- C. Wall-Mounted Water Closets: Install using a combination fixture support and waste fitting installed per manufactures recommendations and height indicated on Architectural drawings.
- D. Urinals: Install with brass nipples. Install at heights indicated on Architectural drawings.
- E. Drains: Where installed in construction with waterproof membrane, provide drains with flashing clamp device with corrosion-resistant clamping bolts.
- F. Fixture Sealer: Install wall-hung fixtures with white silicone sealer between fixture and wall, applied smooth and even.
- G. Fixtures, trim and accessories shall be as indicated in the drawings.

2.16 SPECIALTY ITEMS

- C. Fire Safing: Safe all pipe penetrations through fire rated walls and floors with U.L. listed Proset or Nelson Fire Safing. Install per manufacturer's directions.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection: All plumbing shall be installed in accordance with the requirements of all governing authorities, the original design, and the referenced standards.
- B. Discrepancies
 - 1. In the event of discrepancy, immediately notify the Architect.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
 - 3. Interferences between installed work of various trades due to lack of coordination shall be resolved by Architect whose decision is final. Relocate or offset any work as required to accommodate work of other trades at no extra cost to the Owner when so directed by the Architect.

3.2 LOCATIONS AND SPACE REQUIREMENTS

- A. Contractor shall fully inform himself regarding peculiarities and limitations of spaces available for installation of work under this division. Drawings indicate desired location and arrangement of piping, equipment and other items, and are to be followed as closely as possible. Work specified and not clearly defined by drawings shall be installed and arranged in a manner satisfactory to Architect. In event changes in indicated locations and arrangements are deemed necessary by Architect, they shall be made by Contractor without additional charge provided the change is ordered before work is installed and no extra materials are required.
- B. Verify all spaces, dimensions for all fixtures, equipment, tenant or Owner-furnished equipment and equipment furnished under other sections.
- C. Obtain all necessary rough in data and dimensions for all fixtures, equipment, tenant or Owner-furnished equipment and equipment furnished under other sections.
- D. Maintain ample headroom clearances and accessibility. Maintain ceiling heights.

- E. Constantly check work of other trades to prevent interference with this installation.

3.3 PIPE INSTALLATION

- A. Make pipe runs straight and true. Springing or forcing piping into place is not permitted. Install in manner to prevent any undue strain on equipment. Make joints smooth and unobstructed inside and out, and ream pipe ends thoroughly to remove burrs. Conceal piping in finished portions of the buildings except as otherwise directed or indicated. Cap or plug ends and openings in pipe and fittings immediately to exclude dirt until equipment is installed or final connections are made. Make pipe size reductions with reducing fittings. Use no bushings unless specifically authorized. Use no close nipples. Proceed to rough in as rapidly as general construction of building will permit and complete and test before any lathing, plastering, or drywall, or other finish work is started. Fit work to available space and accurately rough in. Grade and valve water piping so as to provide for complete drainage and control of the system. Provide clamps and/or concrete thrust blocks at dead ends, angles, or other points where separation of joints may occur. Grade vent piping to allow piping to free itself of condensation or water.
- B. Install piping to clear beams unless sleeving is indicated. Constantly check work of other trades to prevent interference with this installation. Obtain approval from Architect if coring or cutting of concrete work is necessary due to failure to install required sleeves prior to the time of concrete pour. Cost of coring and cutting work shall be borne by the subcontractor.
- C. Exposed Plated or Enameled Pipe: Make connections to equipment with special care. Show no tool marks or threads.
- D. Dielectric Unions: Make connections between two dissimilar metal pipes with dielectric unions.
- E. Unions: Provide a union on one side of each shutoff valve, at both sides of automatic valves, at equipment connections and elsewhere indicated or required, unless flanges are indicated.
- F. Floor, Wall and Ceiling Plates: Provide where pipes pierce finished surfaces.
- G. Noise: Install soil, waste, and water piping in manner that prevents any unusual noise from flow of water under normal conditions.
- H. Shutoff Valves: Provide where indicated and required for adequate control of systems and for isolation of fixture groups and equipment.
- I. Buried Piping: Install with minimum 36 in. coverage unless otherwise indicated. Lay piping accurately to grade where invert elevations are indicated. When required, provide thrust blocks per manufacturer's recommendations.
- J. Equipment and Materials: Install per manufacturer's recommendations.
- K. Accessibility: Install work readily accessible for normal operation, reading of instruments, adjustment, service, inspection and repair. Provide access panels where indicated and required.
- L. Pipe Joints: Make screwed joints with a minimum amount of compound applied to the male thread only. All joints shall be made per code requirements.
- M. Provide pipe isolation at all hangers for non-insulated materials.

- N. Piping rough-in for fixtures: Support or secure to building construction or firmly anchored waste piping so that pipes cannot be displaced. Do not secure to walls. Use of makeshift devices, such as rope, wire, tape, etc. is prohibited.

3.4 HANGERS AND SUPPORTS

- A. Hold horizontal pipe runs firmly in place using approved steel and iron hangers, supports, and/or pipe rests unless otherwise indicated. Suspend hanger rods from concrete inserts or from approved brackets, clamps or clips. Hang pipes individually or in groups if supporting structure is adequate to support weight of piping and fluid. Except for buried piping, hang or support pipe runs so that they may expand or contract freely without strain to pipe or equipment.
1. Horizontal steel piping: Provide hangers or supports every 10 ft. except every 8 ft. for piping 1-1/4 in. and smaller.
 2. Horizontal copper tubing: For 2 in. diameter and over, provide hangers every 10 ft.; for 1-1/2 in. diameter and smaller, every 6 ft.
 3. Horizontal cast-iron hub and spigot piping: Provide hangers or supports at each hub.
 4. Horizontal cast-iron no-hub piping: Provide hangers or supports at each side of a no-hub fitting. Provide anti-separation bracing at each 90 degree change of direction.
 5. Vertical piping: Support at floor with iron pipe clamps.
 6. Sway brace in accordance with NFPA 13.
- B. Branches: Provide separate hangers or supports for branch lines 6 ft. or more in length.
- C. Sound and Electrolysis Isolators: Provide at all hangers and supports for hot and cold domestic water lines. Securely attach pipe to walls, studs, etc. All such piping isolated from structure by "Trisolators".

3.5 EXPANSION AND CONTRACTION

Install piping subject to expansion and contraction with expansion loops made up of bends, fittings, or Victaulic couplings, expansion joints, swing joints, or other approved methods or devices. Branch lines from mains subject to expansion and contraction shall have a swing joint at a point of connection with the main. Risers which pass through one or more floors shall have swing joints at their base. Anchor lines subject to expansion and contraction by approved methods to restrict movement.

3.6 CORROSION PREVENTION

Make joint between cuprous and ferrous materials with approved nylon insulating couplings. Separate contact surfaces of dissimilar metals with non-conducting coating or sheet.

3.7 CLEANOUTS

- A. Provide cleanouts where indicated and required. Unless otherwise indicated, cleanouts shall be accessible with extensions to grade, to outside of buildings, or to floors above as indicated

or required. Do not locate cleanouts in public lobbies and public corridors unless approved by Architect.

- B. Membranes: Where waterproofing membrane occurs under floor, bring membrane to cleanout without puncturing, and permanently anchor to integral anchoring flange with a heavy cast-iron clamping collar and rustproofed bolts.
- C. Covers: Set cleanout covers with all finished wall, floor or grade. In all cases securely anchor by means of integral lugs and bolts. Where surfacing material such as resilient covering is specified, ascertain thickness being used and set cleanout top so finished floor is smooth.
- D. Use Acorn 3500 thread compound.

3.8 ACCESS BOXES AND PANELS

- A. Provide valve boxes for valves located below grade. Provide metal access panels of size and type hereinbefore specified for valves or shock absorbers located in concealed areas.
- B. Access Boxes and Panels: Set flush with finished wall, floor or ceiling. Those in finished walls shall have door or plate removed during construction or be otherwise suitably covered to protect finish.
- C. Outside General Service Access Boxes: Provide with metal, asbestos cement, or clay pipe sleeve extensions where added depth is necessary. Do not locate boxes in public walks, driveways or covered passages unless indicated.

3.9 WRAPPING FOR BURIED STEEL AND COPPER PIPING

- A. All buried steel pipe shall be factory coated with Plexco 20 mil high density polyethylene coating (yellow color). Finished coating shall have continuous imprinting of coating type and applicator and pipe type and manufacturer. All fittings and field joints of buried steel piping shall be cleaned, primed then fully protected by wrapping with two separate wrappings (each half lapped) of 0.010x2 in. wide pressure sensitive polyvinyl tape equivalent to Johns-Manville "Trantex." All fitting and joint wrapping shall overlap pipe wrapping a minimum of 2 in.
- B. Affidavit: Deliver coated pipe to jobsite accompanied by applicator's affidavit certifying that wrapped pipe has been given high voltage holiday detector test and that pipe was free of holidays when pipe was shipped from applicator's yard. Submit one copy of every affidavit to Architect prior to installation.
- C. Field Joints: Test field applications for holidays by a high voltage holiday test method in Architect's presence.
- D. Damage: Handle wrapped piping with extreme care to avoid damage. Repair and retest marred or damaged pipe wrapping.
- E. Install cathodic protection for steel or ferrous piping per Corrosion Engineer's recommendations and/or applicator contractor familiar with cathodic protection having a minimum of 5 years experience in the fabrication and installation of cathodic protection.
- F. Copper tubing, pipe wrap same as for field wrap steel fittings, no holiday test required. Backfill with alkalinized clean sand.

- G. Backfill steel and copper piping with clean alkalized sand (1/2 sack lime per cubic yard of sand) a minimum of 4 inches all around pipe and fittings.

3.10 PROTECTION FOR UNDERGROUND DUCTILE AND CAST-IRON PIPE AND FITTINGS

Wrap all pipe and fittings with 10 mil PVC pipe tape and prime per manufacturer's directions, or install in 8 mil polyethylene encasement in accordance with ANSI/AWWA Standard C105/A21.5-82. Bed and backfill with clean alkalized sand (1/2 sack lime per cubic yard) a minimum of 4 inches all around pipe and fittings.

3.11 EXCAVATION AND BACKFILLING

Perform excavation and backfilling required work under this section unless otherwise specified. Conform to requirements of Division 2 and of public authorities having jurisdiction.

3.12 SPECIALTY ITEMS

Install as indicated on the drawings, as herein specified, and as recommended by manufacturer.

3.13 STERILIZATION

Sterilize each unit of water supply and distribution system with liquid chloride or hypochloride before acceptance for operation in accordance with AWWA C601, "Standard for Disinfecting Water Mains." Work shall be done by Contractor and, unless otherwise required by public authorities having jurisdiction, shall conform to the following:

- A. Materials
 - 1. Liquid chlorine: U.S. Army Specification 4-1.
 - 2. Hypochloride: Liquid shall conform to Fed. Spec. O-C-11RA (Int. 4).
- B. Method: Amount of chlorine shall provide a dosage of 50 ppm minimum. Introduce chlorinating materials into lines and distribution system in approved manner. After a contact period of 24 hours minimum during which period chlorine residual shall be maintained at 5 ppm minimum, flush out systems with clean water until residual content is not greater than 0.2 ppm. Flush entire system open and close valves in lines being sterilized several times during contact period.
- C. Test Reports: Furnish one copy of test report of complete and adequate sterilization to Architect before final acceptance of work. Certificates shall bear signature of an official of laboratory responsible for test. Cost of testing laboratory services shall be included in this subcontract.

3.14 TESTS

- A. Perform tests to Architect's satisfaction. Make tests in presence of Architect and at a time suitable to him if requested. Furnish necessary labor and equipment and bear costs for testing. Cost of replacing and/or repairing damage resulting therefrom shall be borne by this Contractor. Should the Contractor refuse or neglect to make tests necessary to satisfy the Architect that requirement of specifications and drawings are met, such tests may be made by an independent testing company and the Contractor charged for all expenses.

- B. Hydrostatic Tests: Make by completely filling piping system with water and eliminating accumulations of air so that leakage, no matter how small, will be apparent on testing gauge immediately. Maintain pressure until pipe under test has been examined, but in no case less than 24 hours. Test systems at following pressure:

<u>SYSTEM</u>	<u>TEST PRESSURE</u>
Domestic cold water	150 psig
Domestic hot water	150 psig

- C. Sanitary Soil, Waste, Vent System Tests: Before installation of fixtures, cap ends of system and fill lines with water to 10 ft. above the section being tested (including vents) and allow to stand until a thorough inspection is made. Make tests in sections if necessary or convenient. However, include interconnections between new sections and previously tested sections in the new test.
- D. Roof drainage system: Test as specified for sanitary system.
- E. Gas systems: Test with compressed air for six hours or longer as directed to prove tight without leaks. Use pressure recorder to record pressure of all lines for duration of test.

3.15 ADJUSTING

Upon completion of work and after cleaning of system, fixtures and equipment, and automatic parts of plumbing system shall be carefully adjusted normal operation. All flush valves and fixture stops shall be checked for proper operation and final adjustments made where required. System shall operate quietly without vibration or noise.

END OF SECTION 15440

SECTION 16120 - CONDUIT AND CABLES**PART I - GENERAL**

1.1 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations required to furnish, deliver and install complete the work shown on the drawings and specified herein. Work includes, but is not limited to the following:
 - 1. Examine all other sections of this specification and the sections of other trades for related work, coordination issues required to be included as work under this section.
 - 2. General provisions and requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Submit product data sheets for all wire, conduit, fittings and splicing materials.
- B. Submit material list for all conduit and fittings.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid steel conduit: hot-dip galvanized, zinc coated. Threads shall be galvanized after fabrication.
- B. PVC coated rigid steel conduit: hot-dipped galvanized after fabrication, with bonded 20-mil coating of polyvinyl chloride.
- C. Electrical metallic tubing: galvanized, seamless steel construction. Couplings and connectors shall be watertight compression type with insulated throat, Thomas & Betts Co. #5123 Series or approved equal.
- D. Flexible conduit: galvanized steel. Connectors shall be Thomas & Betts Co. #3312 and/or #3332 Series, complete with insulated throat, or approved equal.
- E. Liquid-tight flexible conduit: 'Seal-tite' type U.A. Connectors shall be Appleton Series "ST" or approved equal.
- F. Nonmetallic conduit: polyvinyl chloride, Schedule 40 or type "EB". Type "EB" shall be concrete encased.

2.2 WIRE AND CABLE

- A. All wire and cable shall be copper, 600 Volt, #12 AWG minimum unless specifically noted otherwise on the drawings. Conductors #10 AWG and smaller shall be solid. Conductors #8 AWG and larger shall be stranded. Type of insulation as follows:

1. Type THHN, THWN-2 or XHHW insulation.
2. Type THHN insulation may be used for circuit conductors installed in raceways within LED lighting fixtures and the secondary side of LED drivers.
3. Type XHHW or THWN insulation shall be used where conductors are installed in conduit exposed to the weather, underground or damp/wet conditions.
4. Branch circuits shall utilize the following color code:

Neutral White (Tape feeder neutrals with white tape near connections)

a) Normal Power

120/240 Volt

Ground Green
 Phase A Black
 Phase B Red
 Phase C Blue

480/277 Volt

Ground Green
 Phase A. . . . Brown
 Phase B. . . . Orange
 Phase C. . . . Yellow

b) Emergency power same insulation color as normal power except as follows:

120/208 Volt

Provide a continuous color stripe on each conductor's insulation, orange or yellow except ground

480/277 Volt

Provide a continuous stripe on each conductor's insulation blue or black except ground.

5. Identify feeders by phase or leg in each panel board with printed identifying tape.
6. Panel feeders: wire size shall be as shown on the drawings. If aluminum wire is proposed in lieu of copper, size of aluminum conductor shall be increased per CEC Table 310.15(B)(16) to meet the ampere rating of copper wire at 75 degrees C insulation. Voltage drop shall not exceed that of the copper feeders indicated on drawings. Increase conduit size as required by the NEC in Appendix C to accommodate any increase in conductor size and/or counts.

PART 3 - EXECUTION

3.1 TRENCHING, FOOTINGS, SLEEVES

- A. Provide trenching, concrete encasement of conduits, back filling, and compaction for the underground electrical work, in accordance with applicable sections of this specification.
- B. Provide footings for all post and/or pole-mounted lighting fixtures: concrete shall conform to the applicable sections of this specification.
- C. Sleeves
 1. Provide sleeves for raceways and conduit passing through the following construction elements:
 - a) Concrete foundations, floors, walls and slabs.
 - b) Lath and plaster walls and ceilings.

2. Sleeves shall extend 1-½ inches above floors, except under floor standing electrical equipment. Sleeves shall be flush with walls, ceilings, foundations and partitions. Sleeves

shall be installed at exact penetration locations and angles to accommodate raceway and conduit routings.

3. Joists, girders, beams, columns or reinforcing steel shall not be cut or weakened. Where construction necessitates the routing of conduit or raceways through structural members, framing or under footings, written permission to make such installation shall first be obtained from the Architect. Such permission will not be granted, however, if any other method of installation is possible.
4. The Architect shall review the layout and design of raceways and conduits located in or routed through masonry or reinforced beams or walls, before any work is performed. All sleeving shall be accomplished according to the instructions of the Architect and shall be accepted before any concrete is poured.
5. Sleeves, raceways and conduit shall be located to clear steel reinforcing bars in beams. Reinforcing bars in walls shall be offset to clear piping and sleeves.
6. Provide ½" continuous clearance between inside of sleeve and exterior of conduits and raceways passing through the sleeve, unless otherwise specified. Where sleeves pass through outside walls below grade, provide full 1" clearance between exterior of conduits and raceways to interior of the sleeve. For seismic joints, clearance shall be 3".
7. Sleeves set in fire rated membranes shall be filled with a fire rated caulking or sealant equal to the rating of the surface penetrated. The void between conduit or raceway and the sleeve shall be thoroughly filled to provide a fireproof seal.
8. Sleeve Material:
 - a. In floor slab construction: Schedule 40 black steel pipe, with upper surface to be sealed watertight.
 - b. In concrete walls: Schedule 40 black steel pipe. When installed in outside walls, seal outer surface watertight.
 - c. In lath and plaster partitions and ceiling: 24 gauge galvanized iron or steel.
 - d. Sleeves through waterproof membranes: Cast iron or Schedule 40 steel with flashing clamp device and corrosion resistant clamping bolts. Caulk space between pipe and sleeve at outer surface with watertight sealant.

3.2 GROUNDING

- A. Grounding shall be executed in accordance with all applicable codes and regulations including the State of California and local authorities having jurisdiction.
- B. All conduits shall include a properly sized insulated copper grounding conductor(s) with the current carrying conductors in the conduit to serve as an equipment ground.
- C. The maximum resistance to ground shall not exceed 5 ohms.
- D. Where equipment bonding ground wire is installed or where nonmetallic or flexible conduit is used for feeder, subfeeder or branch circuit wiring, a green insulated, copper ground wire, sized in accordance with CEC Table 250.102(c)(1) shall be provided, unless otherwise noted on plans.
- E. Where conductors are run parallel in multiple raceways or cables, the equipment grounding conductor, where used, shall be run in parallel. Each parallel equipment grounding conductor shall be sized on the basis of ampere rating of the overcurrent device protecting the circuit conductors in the raceway or cable in accordance with CEC Table 250.102(c)(1). Where conductors are adjusted in size to compensate for voltage drop, equipment grounding conductors, where required, shall be adjusted proportionately according to circular mil area.
- F. Ground conductors for branch circuit wiring shall be attached to each outlet at the back of the box using drilled and tapped holes and washer head screws, 6-32 or larger.

- G. Each panelboard, switchboard, pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

3.3 CONDUIT

- A. The sizes of the conduits for the various circuits shall be as indicated on the drawings and as required by code for the size and number of conductors to be pulled therein. Conduits shall be routed in a manner so as to conceal them from general view, except where noted otherwise.
- B. Rigid steel conduit shall be used in the following areas:
 - 1. Embedded in concrete.
 - 2. Embedded in brick or masonry walls.
 - 3. Exposed on interior of buildings below eight feet.
 - 4. Exposed on exterior of building.
 - 5. Damp or wet locations where noted.

Rigid steel conduit shall not be installed in direct contact with earth or sand.

- C. PVC-coated rigid steel conduit shall be used for all elbows and risers, for underground nonmetallic conduits, and for all underground microphone, speaker and dimming control circuit conduits.
- D. Electrical metallic tubing up to and including 4 inch may be installed as permitted by codes referenced within specifications.
- E. Flexible steel conduit may be used for equipment and transformer final connections only.
- F. Liquid-tight flexible conduit shall be used for final connection to motors, control devices mounted on vibrating or rotating equipment, equipment indicated on drawings to have flexible conduit connections, and in all areas where exposed flexible connections are required.
- G. Nonmetallic conduit shall be used for all underground runs unless specifically noted or specified otherwise. Nonmetallic conduit shall not be run in slabs or walls, above ceiling or exposed.
- H. Conduit Installation:
 - 1. Securely and rigidly support all conduits from building structure. Conduits shall be supported independent of all piping, ductwork, equipment ceiling hanger wires, and suspended ceiling grid systems. All conduits shall be secured by means of approved pipe clamps or straps. The use of "plumbers tape" is prohibited.
 - 2. Individual conduits suspended above ceiling shall be supported by means of hanger rods and pipe clamps. Multiple conduits suspended above ceilings shall be supported by means of trapeze type hangers and pipe clamps.
 - 3. Individual conduits placed against brick, masonry or concrete walls or slabs shall be secured with pipe clamps and expansion shields. Individual conduits placed against dry wall or plaster construction shall be secured by means of pipe clamps and screws attached to studs or other structural members. The use of toggle bolts is prohibited. Provide preformed channel supports for all multiple conduits placed against walls or slabs.
 - 4. Unless otherwise restricted by structural drawings as specifications the maximum size conduit permitted in concrete slabs or walls shall be not be greater than 1/4 of the slab thickness. Conduits installed in concrete slabs shall not cross.

5. Conduit below slab on grade or underground exterior of building shall be spaced a minimum of 3" between identical systems and 12" between power and all other signal systems except at termination points.
6. Conduits, which are installed at this time and left empty for future use, shall have polyvinyl rope left in place for future use.
7. Conduits stubbed outside of building line for future use shall be terminated a minimum of five feet clear of building or adjacent concrete walks or A.C. paving and capped and marked. Provide tag engraved with the number and size of conduits and type of service (i.e., "POWER", "TEL.", etc.).
8. Provide expansion and deflection fittings, with bonding jumper at all building expansion or seismic joint crossings.
9. Provide two locknuts and an insulated bushing at each metallic conduit terminating at outlet boxes, junction boxes, terminal cabinets, switchboards and panel boards. Provide insulated bushing at each metallic conduit stub-up location. Bushings shall have ground lugs when installed on a metallic extension of PVC conduit run.
10. Provide metallic or plastic caps on all conduits during construction until installation of conductors.
11. Branch circuit and telephone conduits turned up from floor into interior demountable partitions or to equipment not adjacent to any wall shall terminate in flush floor couplings at the floor and then extend into partition or to equipment. Refer to architectural drawings for location of demountable partitions.
12. Conduit run exposed shall be run at right angles and parallel to the walls and structure. All changes in directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds or equal. Conduits run on exposed beams or trelliswork shall be painted to match surrounding surfaces. Conduits run exposed on roofs shall be installed on 2x4 redwood sleepers, maximum 5 foot on centers. Sleepers shall be set in non-hardening mastic.
13. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.
14. From each panel that is flush mounted in a wall, stub up from top of the panel a minimum of four 3/4" conduits to the nearest ceiling spaces or other accessible location and cap for future use.
15. Conduit rising from floor for motor connection shall be independently supported if over 24" above floor. Support shall not be to the motor or ductwork that may transmit vibrations.
16. Concrete for encasement of nonmetallic conduits shall be 200- PSI test with a maximum of 3/4" gravel and red color in mix, (Provide ten pounds of red coloring cement for each cubic yard of concrete). Provide prefabricated plastic spacers, (chairs), between each conduit. Provide a minimum of 2" of concrete between each conduit and a minimum of 3" of concrete on top, bottom and side of duct bank.
17. Provide all trenching, excavation, shoring and backfilling required for the proper installation of underground conduits. Bottoms of trenches to be cut to grade. Make trenches 12" wider than the diameter of the largest conduit or greatest sum of conduits. All conduits exterior to the building slab shall be set on a 6" bed of damp sand, and backfilled to within 12" of finished grade with damp sand. Remainder of backfill to be native soil. Soil shall have no stones or aggregate greater than 3". Do not backfill until installation has been approved and as-built drawings have been brought current. Promptly install all conduits after excavation has been done, so as to keep the excavations open as short a time as possible. All excess soil from trenching shall be removed from the site.
18. Underground conduit shall be installed no less than 24" below finished grade in non-traffic areas, except under buildings and 30" below finished grade in traffic areas, including roads and parking areas. Install long radius bends in all underground conduits in excess of 100 feet long.

3.4 WIRE AND CABLE

- A. Branch circuit and fixture connections for #10 AWG and smaller wire shall be made with UL-approved connectors listed for 600 Volts approved for use with copper wire. Connector shall consist of cone-shaped, heli-coil insert, insulated with a nylon shell and 2 wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by "Scotchlok" by 3M or "WAGO" by Innovative Connections or equal.
- B. Branch circuit connections of #8 AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with copper wire as manufactured by Thomas & Betts or equal. Joints shall be insulated with plastic splicing tape, half-lapped and at least the thickness equivalent to the conductor insulation. Tapes shall be fresh and of quality equal to 3M Scotch.
- C. Use U.L. listed pulling compound for installation of conductors in conduits.
- D. Correspond each circuit to the branch number indicated on the panel schedule shown on the drawings except where departures are approved by the Architect or the Owner's inspectors.
- E. All wiring, including low voltage, shall be installed in conduit.
- F. Control wiring to conform to the wiring diagrams shown on the mechanical drawings and the manufacturer's wiring diagrams.
- G. All splices in exterior pull boxes and light poles shall be cast resin encapsulated.
 - 1. Power conductor splices - 3M Scotchcast Series 82/85/90; Plymouth or equal.
 - 2. Control and signal circuits 3M Scotchcast series 8981 thru 8986, Plymouth or equal.
- H. Neatly group and lace all wiring in panel boards, motor control centers and terminal cabinets with plastic ties at 3" on centers. Tag all spare conductors.

END OF SECTION 16120

SECTION 16140 – WIRING DEVICES**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Boxes, Enclosures, Keys and Locks.
- B. Receptacles and Switches.
- C. Identifications and Signs.

1.02 SUBMITTALS

- A. Submit product data sheets for all wiring devices materials.

PART 2 - PRODUCTS

2.1 BOXES, ENCLOSURES, KEYS AND LOCKS

- A. Outlet Boxes and Fittings:
 - 1. Outlet boxes used in concealed work shall be galvanized or sherardized steel, pressed or welded type, with knockouts.
 - 2. In exposed work, outlet boxes and conduit fittings required where conduit runs change direction or size, shall be cast metal with threaded cast hubs cast integral with box or fitting. Boxes and fittings shall not have unused spare hubs except as otherwise indicated or specified.
 - 3. Fittings shall be cast, non-corrosive metal. Ferrous metal fittings shall be cadmium plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage and burnt-out sand.
 - 4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting used.
 - 5. Light fixture outlets shall be 4" octagon, 4" square, or larger, depending upon number of wires or conduits therein, and shall be equipped with 3/8" malleable iron fixture studs, and plaster rings. Plaster rings shall have round opening with 2 ears drilled 2-23/32" center to center.
 - 6. For local switch outlets use:
 - a) Single: 4" square by 2 1/8" deep box with single gang plaster ring.
 - b) Double: 4" square by 2 1/8" deep box with double-gang plaster ring.
 - c) Multiple, (over two): 4" square by 2 1/8" deep multi-gang box with multi-gang plaster ring as required for devices shown on plan.
 - 7. For specialty outlets use:
 - a) Clocks: Pass/Seymour-LeGrand #S3713-X or equal, (color to be specified by Architect)
 - b) Thermostats: 4" square by 1 1/2" depth box with single-gang plaster ring.

- c) Bells: 4" square by 2 1/8" deep box with full size extension ring.
 - d) Fire pull stations: 4" square by 2 1/8" deep box with single-gang plaster ring.
 - e) Video outlets: 4" square by 2 1/8" deep box with single-gang plaster ring.
 - f) For any classification not listed, conform to UL #514A and UL #514B. Boxes shall be of type, shape, size and depth to suit each location and application.
8. Plaster rings shall be provided on all flush mounted outlet boxes. All plaster rings shall be standard 5/8" except where box is installed in a fire-rated or exterior surface where depth of finished surface will be greater. Coordinate with Architectural Finish Plan.
 9. Where boxes are installed in existing surfaces of plywood or drywall construction, for single or double-gang wiring devices, cut-in, sheet metal "handy-box" shall be used, Bowers #104 or equal.
 10. Factory made knockout seals shall be installed to seal all box knockouts, which are not intact.
 11. At each location where flexible conduit is extended from a flush outlet box, provide and install a weatherproof universal box extension adapter by Bell Electric Company or equal.
- B. Junction and Pull Boxes:
1. Junction and pull-boxes, in addition to those indicated below, shall only be used where absolutely necessary. All junction and pull-boxes shall be rigidly fastened to the structure and shall not depend on conduits for support.
 2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized, spot welded steel with ample laps and shall be rigid under torsion and deflecting forces.
 - a) Surface: boxes shall have auxiliary angle iron framing where necessary to ensure rigidity. Covers shall be fastened to box with a sufficient number of brass machine screws to ensure continuous contact all around and painted with one coat of primer and one coat of aluminum paint.
 - b) Flush: boxes shall be re-drilled and tapped for cover screws in field if boxes are not installed plumb.
 3. Weatherproof junction and pull boxes shall conform to aforementioned requirements for interior boxes with following modifications: cover of flush mounting boxes shall have a weather-tight gasket cemented to and trimmed even with cover all around.
 - a) Surface or semi-flush: boxes shall be UL approved as rain-tight and shall be complete with threaded conduit hubs. All exposed portions of boxes shall be galvanized and finished with a prime coat and coat of baked-on gray enamel.
 4. Underground Concrete Pull Boxes shall be traffic-rated, (reinforced for H-20 bridge loading), pre-cast concrete. All pull boxes shall have a minimum of 6" diameter sump knockout, and 1" diameter ground rod knockout. Furnish and install cable racks on walls. Each rack shall be equipped with 4 porcelain cable holders on a vertical steel mounting bar. Each pull box shall have 3/4" diameter pull irons. Covers shall be traffic-rated types consisting of steel safety plate bolted to frame. Covers shall be marked "Electrical"; "Power"; "Telephone"; "Signal"; or "Ground" as required. Pull boxes shall be as manufactured by Brooks, Associated, Quickset, or approved equal.
 - a) 2'-0"x 3'-0" x 3'-0" I.D. pull boxes and shall consist of a base section, top ring and cover. Base section shall have two 10"x10" knockouts in each 3'-0" side, and one 20"x20" knockout in each 2'-0" side.

- b) 4'-0" x 4'-0" x 4'-0" I.D. pull boxes shall consist of a base section, middle section, top ring, and cover. Base section shall have two 8"x 16" knockouts on each of two opposite sides, and one 20" x 20" knockout on each of the other two opposite sides.
- c) Provide end bells in all duct entrances. Terminate each metal conduit with insulated bushing having grounding terminal, O.Z. type "Big" or equal.
- d) Place pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.
- e) Damp-proof exterior walls and tops which will be below grade with two coats of bituminous coating. A. C. Horn Company "Dehydrating" No. 4, Sonneborn Sons, Inc., "Hydrocide 648", Toch Brothers "RIW Marine Cement Semi-Mastic", or approved equal.
- f) The floor drain in every concrete pullbox shall drain into a sump containing 10 cubic feet of 1" crushed rock; minimum size 48" deep and 36" diameter. Provide 36" length of clay pipe extending down into the sump. Provide a grille over the top opening of pipe.
- g) Install a 3/4" diameter, 10'-0" copper-clad, ferrous steel ground rod in every concrete power pullbox. Locate near a wall with 6" projection above floor for ground clamps. Permanently and effectively ground all metal equipment cases, cable racks, etc., in all pull boxes.
- h) Provide a 6" deep sand base under each pull box.
- i) Identify all power and signal cables by tagging in all manholes and pull boxes. Securely fasten cable identification with nylon cable ties or insulated type TW wire, (tie so that turns of wires do not form a closed electrical circuit).
- j) Top of steel plate shall have a minimum coefficient of static friction of 0.5 ohms for either wet or dry conditions, when tested for any shoe sole material. An independent testing laboratory approved by the engineer, under the direction of a registered Civil or Quality Engineer shall conduct testing and certification of the static friction factor. Testing shall conform to ASTM D1047 or F489 or F609, or other procedure approved by the Engineer.

6. Underground Utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole; size as indicated on Utility engineered Drawings. Utility boxes shall be manufactured by Brooks, Associated, Quickset, or approved equal. Manholes, vaults and pull-boxes required by utility company, and installed by Electrical Contractor, shall meet all requirements of utility company.

C. Keys and Locks:

1. Contractor shall provide 2 keys with each door lock furnished, including but not limited to control cabinets, panel boards and switchboards.
2. Locks shall be keyed to a Corbin 60 key for access to operate equipment and Corbin 70 key for service access. Special keys and locks shall be provided where specified.

2.2 RECEPTACLES AND SWITCHES

A. Receptacles:

1. Duplex receptacles shall be specification grade, 20 amperes, 125 Volts, 3 wire, NEMA 5-20R, side wired with binding screws, parallel slots, U-ground, plaster ears and captive mounting screws. Body shall be phenolic, plastic or 'bakelite'. Receptacles shall be heavy duty, 3 blade current carrying contacts and doublewide

flat blade ground contacts. Receptacles shall be Hubbell, Leviton or approved equal, color shall be per Architect.

2. Ground fault interrupter type receptacles shall consist of a single receptacle with reset device manufactured in a standard configuration for use with a duplex plate. Receptacles shall be feed- thru, 20 ampere, 125 Volts, NEMA 5-20R, white in color and shall be Leviton 6399-I, or equal. Exterior mounted receptacles shall be mounted in a weatherproof box assembly.
3. Weatherproof receptacles shall, except where otherwise indicated or specified, consist of a duplex receptacle as specified herein and a metal plate with die cast hinged lid and weatherproof gasket. Weatherproof receptacles shall be Hubbell, Leviton or approved equal.

B. Switches:

1. Local Switches:

- a) Local switches shall be tumbler type, specification grade, rated 20 amperes at 120- 277 Volts AC only, with plaster ears, binding screws for side wiring, and standard size composition cups which fully enclose the mechanism. Switches shall be approved for use at currents up to the full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80% of the rating for motor loads. Switches shall be single pole, double pole, 3-way, 4-way or non-locking type as defined in drawings. Switches shall be Hubbell 1221-I single pole, 1222-I double pole, 1223-I 3-way, and 1224-I 4-way or approved equal. Color shall be per Architect.
- b) All lockable type switches shall have metal or nylon key guides with ON/OFF indication, and shall be operable by the same key. Keys for lock type switches shall be forked type, cut from 1/16" stock. Fork dimensions shall be: External 1/4", Internal 5/32", depth 3/16" and radius 5/64". Key switches shall be Hubbell 1221-L single pole, 1222-L double pole, 1223-L three-way or 1224-L four-way or approved equal. Where pilot light is required for key switch see paragraph on "Pilot Lights". Color shall be per Architect.
- c) Pilot light switches shall be rated for 20 amps and shall conform to the specifications for "local switches". The switches shall have red, rugged "Lexan" handles that are lighted by long-lasting neon lamps. Pilot light shall illuminate when load is engaged. Single pole, 120 volt switches shall be Hubbell 1221-PL. Single pole, 277 volt switches shall be Hubbell 1221- PL7. Color shall be white.
- d) Remote control switches for mechanically held contactors shall be arranged for 3-wire control and shall be momentary contact, single pole, 3-position tumbler type with center "OFF". Switch shall be rated for 20 Amperes at 120-277 Volts AC. Switch shall have plaster ears with binding screws for side wiring, standard size composition cups which fully enclose mechanism and ivory handles; Hubbell 1556-I.

2. Timeclocks and Photo Electric Controls:

- a) Timeclocks shall be 7-day solid state electronic, astronomic type capable of fully automatic or manual operation. Timeclocks shall be housed in a sheet steel enclosure unless built into a panel or switchboard. Contacts shall be rated for 30 Amps resistive or inductive load each pole, 120-277V AC, 5 amp tungsten or 40 V AC pilot duty- each pole 240 V AC. Time switches shall have a non-volatile clock and non-volatile memory and it shall have a built-in rechargeable power carry-over system. Switch shall have a minimum of 15 on/off set points per week. Timing shall be in one-minute increments with a minimum on or off time of one minute. Time switch shall have a digital display that shows days of week, hours and minutes. Display shall have a load status

- light to indicate when equipment is in operation. Time switch shall be equal to EZ Controls Model EZ-701-1, single pole or Model EZ-701-2, double pole.
- b) For outdoor lighting control, time switches shall be digital with astronomic capabilities. Time switches shall have 365 day with holiday capabilities of 16 single dates and 5 blocks of unlimited duration utilizing an 8th and 9th day schedule. Time switch shall have 2 separately controlled relay closure output circuits. Each circuit shall be single pole, double throw, with contacts rated for 10 Amps resistive at 120/250 V AC and 7.5 Amp inductive at 120/250 V AC. Time switch shall have 48 events per circuit per week; separate scheduling for each day of week. Time switch shall have user selectable daylight saving or standard time, automatic leap year correction, and 72 hour memory backup with rechargeable battery. Time switch shall be equal to Tork series DZS-200.
 - c) Where more than 2 timed circuits are required, time switch shall be equal to Tork 'K' series digital 4, 6 or 8 circuits with following features:
 - 1. Liquid Crystal Display Panel.
 - 2. Holiday Scheduling: Up to 40 dates may be assigned special holiday schedules, up to one year in advance.
 - 3. Automatically adjusts to and from daylight savings time and for leap year.
 - 4. Contact Ratings: 30 amp at 120-277 V AC.
 - 5. Safety override switch for each circuit to provide shut down of circuit or override ON.
 - 6. Selective Review: All or part of schedule shall be displayed at touch of a key.
 - 7. Battery backup for up to one year.
 - 8. Supply Voltage: 120-277V.
 - 9. 365 Day Advance Scheduling.
 - d) Photoelectric Control: Photoelectric control shall be rated for 2000 Watts, 120-277V with single pole, single throw, normally closed contact, enclosed in a die-cast aluminum gasketed enclosure with 1/2" conduit fitting, equal to Tork series 2100.

2.3 IDENTIFICATION AND SIGNS

A. Name Plates:

- 1. The following equipment shall be provided with name plates unless otherwise specified: switch boards, motor control centers, control panels, push button stations, time switches, contactors, motor starters, motor switches, lighting and appliance panel boards, power panel boards, and terminal cabinets.
- 2. Nameplates shall adequately describe equipment designation, voltage and phasing. Lettering shall be black and white nameplate stock of bakelite with characters cut through black exposing white. Plates shall have beveled edges and shall be securely fastened in place with #4 Phillips head, cadmium plated steel, self-tapping screws. Characters shall be 3/16" high.

B. Markings:

- 1. Following equipment and controls shall have markings:
 - a) Surface-mounted starters, switches, disconnect switches, contactors, and other devices controlling motors and appliances. Abbreviations shall conform to American National Standards Institute, (ANSI), Y1.1 and utilize an

identifying number appropriate to the equipment being identified. Markings shall be done with locking type stencils using paint of a contrasting color. Figures shall be 3/8" high unless otherwise indicated.

2. High Voltage: switchboards, cabinets, box, and conduits exposed in accessible locations including under buildings and in attics shall be marked "DANGER-HIGH VOLTAGE". Markings for switchboards shall consist of an #18 gauge steel, porcelain enamel sign, of standard manufacture. Markings for boxes, cabinets and conduits shall be by means of stenciling or printed self-adhesive markers, Westline "Tel-A-Pipe". Letters shall be black on orange background and not less than 1-7/8" high. On conduit runs, marking shall be applied at intervals not exceeding 10' in any individual area. Markings shall be done only after other painting has been completed.
- C. Warning Signs:
1. Provide a warning sign on outside of each door or gate to rooms or enclosures containing high voltage equipment. Signs shall read: "DANGER- HIGH VOLTAGE-KEEP OUT". Signs shall be 7" x 14" with all lettering 1" high except word "DANGER" which shall have 1-1/2" high letters.
 2. Provide a warning sign on each high voltage non-load break disconnect and fused cutout (not oil filled). Signs shall read: "DO NOT OPEN UNDER LOAD". Lettering shall be 1" high.
 3. Signs shall be of standard manufacture #18 gauge steel, with porcelain enamel finish. Letters shall be red on white background.

PART 3 - EXECUTION

3.1 BOXES; INSTALLATION AND SUPPORT

- A. Outlet boxes shall be flush with finished surface of wall or ceiling. They shall be plumb and securely fastened to structure, independent of conduit. Except where otherwise indicated, factory-made bar hangers shall be used to support outlet boxes.
- B. Outlet boxes installed in suspended or furred ceilings with steel runner or furring channels, shall be supported, except where otherwise indicated, by a Unistrut #P-4000 channel spanning main ceiling runner channels. Each box shall be supported from its channel by a 3/8" 16 threaded steel rod with a Unistrut #P-4008 nut and a Tomic #711-B "Adapta-Stud". Rod shall be tightened to a jamb fit with channel and its nut. Box shall be locked to the rod by means of a 1/2" locknut on stud and a 3/8" x 16-point nut locking stud to rod.
- C. Heights of outlets and equipment indicated on Drawings shall take precedence. Where dimensions are absent, the following heights shall be maintained, (heights are to centerline unless otherwise noted):
 1. Pushbutton, light switch, other switches, and fire station outlets: 48".
 2. Desk public telephone and receptacle outlets 18".
 3. Panel boards and terminal cabinets: 6'-6" to top.

3.2 COVERPLATES

- A. Provide a coverplate on each new switch, receptacle, pilot light, buzzer, interphone, public telephone and on existing and reset outlets where so indicated. Coverplates shall be of

unbreakable nylon unless otherwise specified. Public telephone outlet plates shall have single bushed openings. Sectional plates will not be accepted.

- B. Provide a blank coverplate for flush wiring devices and signal system outlets with unbreakable nylon plates. Provide Wiremold # 5736 or equal steel covers painted to match the surrounding finish for flush lighting outlets to be capped. Provide blank stainless steel covers for surface-mounted outlets indicated to be capped.
- C. Identification: switch and receptacle cover-plates shall be provided with engraved designations under any one of following:
 - 1. Three gang and larger gang switches.
 - 2. Lockable switches.
 - 3. Pilot switches.
 - 4. Switches in location out of direct line-of-sight of the fixtures or equipment controlled.
 - 5. Remote switches not in same room with fixtures or equipment such as: unit heaters, air curtains, fly fans, exhaust fans, etc.
 - 6. Receptacles operating at other than 120 volts.
 - 7. Locations indicated on Drawings.
 - 8. Switches operating at 277 Volts.
- D. Designations shall be as indicated on Drawings or as specified and shall be engraved in metal plates, (finish per architect), with 3/16" high block type letters filled with black enamel. Where designations are not indicated, or specified shall be given after Contract is awarded, (for estimating purposes, they may be assumed not to exceed more than 10 letters per gang).

3.03 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

- A. Circuitry from switch boards, motor control centers, transformers, panel boards, circuit breakers, disconnecting switches, starters, pushbutton control stations and other apparatus used for operation or control of appliances or equipment shall be properly identified by means of descriptive nameplates or tags permanently attached to apparatus wiring.
- B. Nameplates shall be engraved laminated bakelite or etched metal. Shop drawings with dimensions and format shall be submitted to the Architect before installation. Attachment to equipment shall be with escutcheon pins, rivets, self-tapping screws or machine screws. Self-adhering or adhesive backed nameplates are not acceptable.
- C. Tags shall be attached to feeder wiring in conduits at every point where runs are broken or terminated, and shall include pull wires in empty conduits. Circuit designation, phase and function shall be indicated. Branch circuits shall be tagged in panel boards and motor control centers. Tags may be made of pressure-sensitive plastic or embossed self-attached stainless steel or brass ribbon.
- D. Circuit cards and cardholders shall be provided for circuit identification in panel boards. Cardholders shall consist of metal frame retaining a clear plastic cover permanently attached to inside of panel door. List of circuits shall be typewritten on a card. Circuit description shall include name, number of circuit, room number and connected load.
- E. Junction and pullboxes shall have covers stenciled with box number when indicated on Drawings, or circuit numbers according to panel schedules. Data shall be lettered in a conspicuous manner with a color contrasting with finish.

- F. Name as designated in part 2A shall be correctly engraved with a legend indicating function or areas, when required by Codes, or indicated on Drawings.

END OF SECTION 16140

SECTION 16425 - SWITCHBOARDS**PART 1 - GENERAL**

1.01 SUMMARY

- A. Work included: All labor, materials, appliances, tools, equipment necessary for performing all operations in connection with furnishing, delivering and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following.
- B. Examine all other specification sections and drawings for related work required to be included as work under Division 16.

1.02 REFERENCE: MANUFACTURER;

- A. Eaton or approved equal

1.03 SUBMITTALS

- A. Provide schematic "ladder type" logic control wiring diagrams and "point to point" control wiring diagrams showing control and protective systems interlocks.
- B. Provide submittal for switchboard indicating all required dimensions, overcurrent devices, fully rated or series rated devices, panels and distribution boards.

1.04 APPLICABLE STANDARDS

- A. The Switchboard(s) shall be designed, assembled and tested in accordance with applicable ANSI, IEEE, NEMA, and UL Standards.

PART 2 - PRODUCTS

2.1 SCOPE

- A. Furnish and install, as shown on the drawings, all service entrance and distribution switchboards as specified herein. Note: Dimensions of switchboard(s) shown on drawings must not be exceeded. If Substitution is provided, layout of equipment must be submitted with shop drawings and shall fit in the allocated space shown on the drawings.

2.2 CONFIGURATION

- A. The switchboard(s) enclosure type shall be as shown on the drawings and meet the environment which they are installed. The switchboard(s) shall be of modular type construction with the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides, top and rear shall be covered with removable screw-on code gauge steel plates. The enclosure shall be NEMA 1 indoor or NEMA 3R

outdoor.

- B. Switchboard(s) shall include all protective devices and equipment as listed on the drawings with necessary interconnection, instrumentation and control wiring. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips.
- C. Switchboard(s) shall be constructed in accordance with the latest NEMA PB-2 and UL 891 standards.

2.3 BUS REQUIREMENTS

- A. The bus bars shall be tin plated aluminum of sufficient size to limit the temperature rise to 65 degrees C, based on UL tests.
- B. Where 100% rated bus is indicated, bus bars shall be sized at a maximum current density of 750A for aluminum and 1000A per square inch for copper.
- C. All switchboard(s) shall have 100% rated bus bars unless shown otherwise on the drawings.
- D. The bus bars shall be braced as shown on the single line diagram and supported to withstand mechanical forces exerted during short circuit conditions when directly connect to a power source having the indicated available short circuit conditions when directly connected to a power source having the indicated available short circuit current.
- E. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings. Provide a 200% neutral bus where indicated on the drawings.
- F. The through bus on the end section shall be extended and pre-drilled to allow the addition of future sections with standard splice plates.
- G. Grade 5 bolts shall be used as bus joints.
- H. Ground bus and lugs shall be furnished. The ground bus shall extend the entire length of the switchboard(s) and shall be firmly secured to each vertical section.

2.4 SERVICE SECTION

The service section shall be manufactured per the system parameters and include the required power company termination, dimensions and metering section. The manufacturer's shop drawings shall be submitted to the serving utility for their approval.

2.5 MAIN AND BRANCH PROTECTIVE DEVICES

- A. Circuit Breakers
 - 1. All circuit breakers shall be listed by underwriters Laboratories, Inc. conforms to applicable requirements of NEMA Standard Publication No. AB1 and meet appropriate classifications of Federal Specification W-C 375B/GEN.
 - 2. Molded case circuit breakers shall be quick-make, quick break trip-free with an interrupting capacity as indicated on the drawings.
 - 3. Main and feeder breakers, 1000 Amp or larger at 277/480 volt, shall be provided

with integral ground fault protection. Ground fault pick-up shall be adjustable from 20% to 70% of circuit breaker maximum continuous current rating, but in no case greater than 1200 amps. Ground fault time delay shall be adjustable with three I squared t ramps.

4. Where indicated on the drawings and in the combination motor starter and/or motor control center schedules, furnish instantaneous magnetic trip only circuit breakers for motor short circuit protection. The magnetic trips shall be adjustable and accessible from the front of the breakers.
5. The interrupting rating of all circuit breakers shall be as shown on drawings, and in no case, be less than the available short circuit current from the utility at the point of service. This short circuit rating shall also correspond to the UL listed integrated short circuit current rating specified for the switchboard.

B. Fusible switches

1. Where indicated on the drawings, provide fusible switches of the quick-make, quick-break type with rejection clips for use with Class "R" fuses. Switches with ratings up to and including 100A shall be twin mounted. Fuses shall be dual element, current limiting type unless otherwise indicated on the drawings. Provide one spare set of fuses of each size and type in each switchboard.

C. Series Connected Combinations

1. The minimum interrupting rating of circuit breakers and fusible switches used as feeders and branches shall be in accordance with prescribed UL recognized series-connected combinations. All electrical equipment using these UL recognized combinations shall be clearly marked indicating the same. At submittal of shop drawing submit UL listing of proposed combination devices for review.

D. Ground fault Protection

1. Manufacturer's standard ground fault protection system shall be provided on service entrance main and branch protective device(s) in accordance applicable sections of the California Electrical Code. CEC Section 230.95 requires the ground fault system to have Performance Testing. The testing shall be performed by an independent testing company and the test shall be per the instructions provided with the equipment. A written record of this test shall be made and shall be available to the Authority Having Jurisdiction.

- E. Arc Energy reduction system shall be provided to comply with CEC 240.87. Provide an energy-reducing maintenance switch with local status indicator on all overcurrent devices for which the installed circuit breaker is rated or can be adjusted to 1200 amperes or higher. Provide documentation per CEC 240.87.

2.6 TESTING

- A. Prior to shipment each switchboard shall be tested to UL 891, the dead front switchboard standard. A dielectric test shall be conducted at two times the switchboard voltage rating plus 1000 volts. External device ground fault systems shall be tested at 57% control voltage to ensure operation under sever ground faults.

PART 3- EXECUTION

- 3.1 Install switchboard(s) in accordance with manufacturer's written instructions and applicable

portions of NECA's "Standards of Installations" for switchboard and motor control centers.

3.2 Bolt switchboard(s) to floor and wall where wall exists per manufactures recommendations. Where units are free standing, provide preformed steel channel or angle iron bracing to nearest wall or building structural member as directed by manufacture. Submit structural calculations and details. Shall meet size zone 4 requirements.

3.3 Identification

- A. Provide a red and white Bakelite nameplate with ½" high letters on each 277/480 volt switchboard fastened to face of dead-front plate, to read: "WARNING 277/480 VOLT".
- B. Manufacturer shall stencil the equipment name on each device and equipment section to correspond to the identification on the drawing.
- C. Devices mounted in switchboard controlling protective devices shall be provided with nameplates indicating device controlled or monitored.

END OF SECTION 16425

SECTION 16452 - GROUNDING**PART 1 - GENERAL****1.1 DESCRIPTION****A. Work Included:**

1. Provide and install a grounding system as specified and indicated on plans.

B. Related Work:

1. See other related sections for their system grounding requirements.

1.2 SYSTEM REQUIREMENT**A. Grounding shall be as approved by the State of California, Division of Industrial Safety and CEC requirements.****B. Electrical continuity to ground metal raceways and enclosures, isolated from the equipment ground by use of non-metallic conduit or fittings, shall be provided by a green insulated grounding conductor of approved size within each raceway connected to the isolated metallic raceways, or enclosures at each end. Each flexible conduit over six feet in length shall be provided with a green insulated grounding conductor of approved size.****C. Cold water or other utility piping systems shall not be used as grounding electrodes, due to the use of insulating couplings and nonmetallic pipe in such installations. All grounding electrodes shall be "made electrodes" specified as follows:**

1. Grounding electrodes as specified below in Part 2 Paragraph 2.01 B of this specification.
2. Concrete enclosed electrode, which is made up of at least 20 feet of copper conductors, encased by at least 2 inches of concrete, located within or near the bottom of a concrete foundation, or footing, which is in direct contact with the earth.

D. Non-current-carrying metal parts of all equipment enclosure, signal and power conduits, switchboard and panelboard enclosures, motor frames, equipment cabinets, and metal frames of buildings shall be permanently and effectively grounded.**E. Metallic or semi-conducting shields, and lead sheaths of all cables operating at high voltage, shall be permanently and effectively grounded at each splice and termination.****F. The neutral of service conductors shall be grounded as follows:**

1. The neutral shall be grounded at only one point within the particular service. Preferable location of the grounding point shall be at the service switchboard, or main switch.
2. The equipment and conduit grounding conductors shall be bonded to that grounding point.
3. If other buildings on the campus are served from a switchboard or panelboard in another building, the power supply is classified as a feeder and not as a service.
4. The equipment grounding conductor is carried from the switchboard to each

individual building. At the building, the grounding conductor is bonded with the power equipment enclosures, metal frames of building, etc., to the "made electrode" for that building.

5. The neutral of the feeder shall not be grounded.
- H. If there is a distribution transformer at a building, the secondary neutral conductor shall be grounded to the "made electrode" serving the building.

1.3 SUBMITTALS

- A. Submit a material list in accordance with the Submittals section of the General Conditions of this Specification.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Yard boxes shall be precast concrete and shall be approximately 11" wide, 17" long, and 12" deep (outside dimensions), or larger, if necessary to obtain the required clearances. Boxes shall be equipped with bolt-down, checkered, cast iron covers and a cast iron frame cast into the box. Yard boxes shall be Brooks 36 or approved equal.
- B. "Made" electrodes shall be approved copper-clad steel ground rods, minimum 3/4" diameter, 10'-0" long.

PART 3 - EXECUTION

3.1 INSTALLATION

- A.
 1. Grounding electrodes shall be located in the nearest usable planting area, where not otherwise indicated on the Drawings, and each electrode shall terminate within a concrete yard box installed flush with finish grade. In planting areas, concrete yard box shall be 2" above planting surfaces.
 2. The grounding electrode may be installed in the power distribution underground hand-hole, if that hand-hole is no more than 20 feet from the building being served.
- B. If the concrete enclosed electrode is used, the grounding wire shall terminate to a suitable copper plate with grounding lugs.
- C. Grounding rods shall be driven to a depth of not less than 8'-0".
- D. Grounding electrodes shall have a resistance to ground of not more than 5 ohms.
- E. When using grounding rods, if the resistance to ground exceeds 5 ohms, two or more rods connected in parallel shall be provided to meet the grounding resistance requirement.
- F. The minimum number of ground rods shall be as required by state electrical safety orders.
- G. Ground rods shall be separated from one another by not less than 6'-0"
- H. Parallel grounding rods shall be connected together with approved fittings and approved grounding conductors in galvanized rigid steel conduit, buried not less than 12" below finish

grade.

- I. The grounding resistance shall be tested by an approved independent testing laboratory, in the presence of the Electrical Inspector. The test results shall be submitted to the Electrical Engineer.

END OF SECTION 16452

SECTION 16461 - TRANSFORMERS**PART 1 - GENERAL**

1.1 SUMMARY

- A. Work Included: All labor, materials, appliances, tools equipment necessary for and incidental to performing all operations in connection with furnishing, delivering and installation of the work of their Section, complete, as shown on the drawings and/or specified herein.
 - 1. Examine all other specification section and drawings for related work required to be included as work under Division 16.
 - 2. General provisions and requirements.

1.2 REFERENCE: MANUFACTURER: Eaton or approved equal

1.3 SUBMITTALS

- A. Shop Drawings: Include manufacturer, catalog number, dimensions, enclosure type, finish winding material, type of core steel, insulation class, design temperature, kVA rating, primary and secondary voltage, K-Factor rating, impedance and taps as applicable.

1.4 APPLICABLE STANDARDS

- A. Transformers shall be constructed in accordance with the relevant NEMA and ANSI Specifications and must be UL Listed with a 220 degrees C insulation.
- B. All transformers 15KVA or greater, shall meet the energy efficiency of the DOE 2016.

PART 2- PRODUCTS

- 2.1 Furnish and install dry type insulating transformers of the voltage, phasing and KVA as shown on the drawings.
- 2.2 The transformer cores are to be constructed of high grade, non-aging silicon steel laminations with high magnetic permeability, and low hysteresis and eddy current losses. Electrical steel graded M-6 or better shall be used. Magnetic flux densities are to be kept well below the saturation point. The core shall not saturate even when the transformer is subjected to 110 percent of nameplate voltage. The core shall be of the cruciform configuration. The core laminations shall be clamped together with heavy structural steel angles.
- 2.3 All transformers shall have a full load temperature rise of 150 degrees C. The temperature rise shall be designated on the transformer nameplate.
- 2.4 The transformer windings shall be electrical grade aluminum. The coils shall be barrel wound and have an outer wrap of insulating *material* when the BIL level specified is 30 KV or below. Transformers with a BIL level higher than 30 KV shall have their primary wound in a disc effect of short circuit currents. The coils shall be impregnated with a 150 degrees C UL recognized

insulating varnish and thoroughly baked.

- 2.5 Primary taps shall be full capacity, with a minimum of 4-2.5% above and below normal high voltage rating.
- 2.6 The enclosure shall be constructed of heavy gauge sheet metal in accordance with the latest NEMA, ANSI, and UL requirements for dry type transformer enclosure. Bases for general purpose transformers shall be fabricated of 12 gauge steel; substation transformer enclosures shall be manufacture of structural steel. Suitable lifting means shall be provided. Paint shall be UL recognized for outdoor service.
- 2.7 The transformer enclosure shall be NEMA 1 or NEMA 3R as indicated on the drawings. When the enclosure is required to be NEMA 3R, the entire assembly shall be UL Listed for outdoor application.
- 2.8 Sound levels of the transformers shall be guaranteed by the manufacturer not to exceed the standards established by NEMA. The core and coils of all transformers with a rating of 15 KVA and higher shall be isolated from the enclosure by vibration pads.
- 2.9 K-Factor Transformers

Where indicated of the drawings, supply and install UL Listed K-Factor rated transformers. All above sections in addition to items below all items above apply to K-rated transformers. In addition, the following features shall be provided with all K-Factor rated transformers.

- A. Transformers having wye connected secondary shall have a neutral capable of carrying 200% of the line current continuously.
- B. The transformers shall be designed to accommodate a load which draws non-sinusoidal currents. The transformer shall not exceed its normal full load temperature rise. The K-Factor is to be clearly stamped on the enclosure immediately below the nameplate. The transformer shall be UL Listed and labeled for the K-rating required.
- 2.10 Transformers rated over 112.5KVA shall have a class 155 or higher insulation system and be completely enclosed except for ventilating openings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Transformer core frame shall be installed level.
- B. Mounting bolts on floor mounted transformers shall be extended into pads only and shall not be in direct contact with building structural members.
- C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits or bus ducts where required.
- D. Liquid tight flexible metal conduit shall be used on both feeders on primary and secondary side of transformer.
- E. For Floor-mounted transformers, we recommend type E isolator, with 0.3 inch static deflection. Type E is a neoprene isolator incorporating a steel housing capable of resisting a seismic load of 1.0 G in all directions. The mount shall consist of a captive steel insert embedded into a neoprene element which is enclosed by a steel housing which also

includes floor mounting holes. The isolator shall have a rated deflection of 0.15 inches compression, 0.12 in tension and 0.09 inches in shear.

- F. Wall mounted transformers shall utilize manufacturers mounting Brackets. Contractor is responsible coordinating with structural engineer to insure wall is capable of supporting the transformer and complies with all codes.

3.2 VOLTAGE CHECK

The Contractor shall set the taps on all transformers which are a part of this contract, as necessary to provide satisfactory operating voltages with all present loads energized, including the new loads and any existing loads.

END OF SECTION 16461

SECTION 16470 - PANELBOARDS**PART 1 - GENERAL**

1.01 SUMMARY

- A. Section Includes: Lighting and power distribution facilities, including panelboards.

1.02 SUBMITTALS

- A. Shop Drawings: Include a front elevation, indicate cabinet dimensions, overcurrent device sizes, poles and arrangement, voltage, amperage, type of mounting, finish and NEMA listing.

1.03 DESIGN REQUIREMENTS

- A. Lighting and Appliances Panelboards:

1. Lighting and appliance panelboards shall be wall-mounted, enclosed safety type with 277/480 volt, 4-wire or 120/208 volt, 4-wire solid neutral mains as indicated on Drawings or specified.
2. Single pole branches shall be molded case, thermal magnetic circuit breakers with inverse time delay, trip free, quick-make, quick-break mechanism and silver alloy contacts. Circuit breakers shall be rated as indicated on Drawings, with ampere rating marked on handle and shall indicate "ON - OFF" and tripped positions. Ground fault interrupters shall be incorporated into circuit breakers where indicated. They shall be listed by UL as a ground fault device.
3. Two and 3 pole branches shall be enclosed, and shall be thermal magnetic circuit breakers with inverse time delay, non-tamper, ambient compensated, single handle, internal common trip, and quick-make, and quick-break mechanism with silver alloy contacts. Circuit breakers shall be rated as indicated on the Drawings.
4. Main and sub-feeder circuit breakers shall be enclosed, thermal magnetic type with inverse time delay, single handle common trip, quick-make, quick-break mechanism, corrosion resistant bearings and silver alloy contacts. Ampere frame size and trip rating shall be as indicated on Drawings. Breakers over 225 amperes shall have interchangeable trip units. Handles of main and sub-feeder circuit breakers shall be under cabinet door. Voltage rating shall be as indicated on Drawings.
5. All circuit breakers shall be one-piece, bolt-on type and shall meet short circuit interrupting capacity requirements indicated on Drawings, including series rating.
6. Breakers shall have a minimum short circuit interrupting rating of 10,000 amps symmetrical for panels board voltages up to 240 volts and 14,000 amps symmetrical through 600 volts or as specified on drawings. Interrupting rating shall not be less than the utility contribution plus motor contribution.
7. Except where otherwise indicated, circuit breakers shall be in 2 vertical rows connected to bus bars in a distributed phase arrangement. Two pole branches shall be balanced on busses. Each single pole branch shall be

- numbered adjacent to its circuit breaker with odd numbers on left and even numbers on right.
8. All specified circuit breaker spaces shall include necessary hardware required for future installation of circuit breakers.
 9. Provide locking devices for each individual circuit breaker where specified.
- B. Power Panelboards: Power panelboards shall conform to the Specifications for lighting and appliance panelboards, where applicable, except that mains shall be bussed 240 or 480 volts, 3 phase, or as required, and that branches shall be enclosed, quick-make, quick-break thermal-magnetic circuit breakers with inverse time delay trip, of frame size and trip rating indicated, and with corrosion-resistant bearings, silver alloy contacts and single handle, common trip, free operation. Breakers over 225 ampere size shall have interchangeable trip units. Main shall be as indicated on Drawings. All circuit breakers shall be one-piece, bolt-on type.
- C. Panelboard Cabinets:
1. Panelboard cabinets shall be code gage galvanized steel or blue steel; fronts, doors, and trims shall be code gauge furniture steel.
 2. Where contactors, time switches, and control devices are specified or indicated to be installed within panelboard cabinets, a separate compartment and door shall be provided at top of cabinet for such devices. Door shall be sized as required to permit removal of contactor and other devices intact.
- D. Panelboard Schedule: Contractor shall prepare a neatly typewritten schedule with number or name of room or area, or load served by each panelboard circuit. Room numbers or names used shall be determined at site and shall not necessarily be those used on Drawings. Schedule shall also indicate panel designation, voltage and phase, building and distribution panel or switchboard from which it is fed. Schedule shall be mounted in a frame under transparent plastic 1/32" thick on inside of each panelboard cabinet door.
- E. Panelboard Standards: All panelboards shall meet latest revisions of following standards:
1. California Electric Code, Article 408.
 2. UL 67, Panelboards.
 3. UL 50, Cabinets and Boxes.
 4. UL 943, GFCI.
 5. UL 489, Molded case circuit breakers.
 6. NEMA PBI.
 7. Federal Specifications W-P-115 and WC-375B.
 8. Panelboards must be UL labeled.
- F. Terminal Cabinets, Signal:
1. All signal terminal cabinets shall conform in every respect to the Specifications for panelboard cabinets, except as modified herein.
 2. All terminal cabinets shall be flush type, with 2" trim or surface mounted type, as indicated on Drawings. All terminal cabinets shall have section. Cabinets shall be provided with barriers to separate each system. Sections over 24" in width shall be provided with double door and lock. Each terminal cabinet, or section of a terminal housing a separate system, shall measure 12" long x 18" high x 5-3/4" deep, unless otherwise indicated on Drawings. Trims for sectional cabinets shall be of one-piece construction.

3. All terminal cabinets shall be equipped with 3/4" thick plywood backboards within cabinets, and fastened in place with machine screws. Backboards shall be largest size cabinet and conduit terminations will permit.
4. Flush mounted terminal cabinets shall be finished as specified for flush mounted panelboard cabinets. Surface and semi-flush mounted terminal cabinets shall be finished as specified for surface mounted panelboard cabinets.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Panelboards shall be manufactured by Eaton, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fronts shall be flush or surface type, as required. Fronts shall be fastened to cabinets with 1/4" #20, nickel-plated oval-headed machine screws and cup washers. Sufficient screws shall be installed to prevent buckling or warping of cabinet front. Flush type fronts shall be aligned plumb and square and cabinet shall be drilled and tapped, at site, for cover screws, to accomplish this if necessary.
- B. All surfaces of flush mounted cabinets shall be galvanized. Fronts shall be given 2 coats of metal primer and shall not be installed on cabinets until after finish coats of paint have been applied to wall and cabinet fronts and are thoroughly dry. Screws and cup washers shall not be painted.
- C. All surfaces of surface mounted cabinets and fronts shall be given one coat of metal primer and a finish coat of baked-on gray enamel.
- D. Cabinets shall be rigidly supported in place, independent of conduits.
- E. On floor-standing units, provide 1" minimum grout to set and level cabinets.
- F. Cabinets installed outdoors shall be weatherproof, NEMA 3R.

END OF SECTION 16470

SECTION 16481 – MANUAL AND MAGNETIC MOTOR CONTROLLERS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Work Included: all labor, materials, appliances, tools, equipment necessary for performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other specification sections and drawings for related work required to be included as work under Division Sixteen.
 - 2. General provisions and requirements for electrical work.

1.2 SUBMITTALS

- A. Provide catalog cuts on all standard catalog products.
- B. On all assembled-to-order products, including Motor Control Centers, submit elevation views that illustrate device locations, section dimensions, weights and shipping splits.
- C. Provide bills of material listing all major components.
- D. Provide schematic ladder type control wiring diagrams showing the control system for HVAC equipment and other electrical equipment.

PART 2 - PRODUCTS**2.1 INDIVIDUAL MANUAL MOTOR STARTERS**

- A. Provide flush or surface mounting manual motor starters with number of poles and size of thermal overload heaters as required for the motor being controlled (equipped with overload heaters, one for each motor lead). Back boxes shall be supplied with all flush mounting starters whether they are toggle type requiring only a 4" square outlet box or the larger type requiring a special box and cover designed to accept the particular unit.
- B. Unless otherwise noted on the drawings, all manual starters for single phase motors, smaller than 1 HP, shall be the compact toggle type. Manual starters for all single phase motors, 1 to 5 HP, and all three phase motors up to 5 HP shall be the heavy duty type.
- C. Where manual motor starter(s) is shown with pilot light(s), the pilot light(s) shall be installed in a separate outlet box adjacent to the starter outlet, and engraved nameplate to indicate function of pilot light(s).
- D. Manufacturer: Manual Motor Starters shall be Siemens Class SMF for motors 1 HP and below; and Siemens Class 3VU13 for motors 1 to 5 HP, or approved equal.

2.2 INDIVIDUAL COMBINATION MOTOR STARTERS

- A. Combination starter units shall incorporate fused or non-fused disconnect switch, or circuit breaker and an individual magnetic motor starter in a common enclosure. See drawings for specific requirements. The interrupting capacity shall equal or exceed the maximum available fault current specified. Combination starters shall be mounted in NEMA 1 enclosures, unless otherwise noted on the drawings. Starters shall be Siemens Class SCF, SCN or SCB.
- B. An external operator mechanism shall provide the means for operating the disconnect. This operator shall clearly indicate whether the disconnect is "ON" or "OFF". With the disconnect in the "ON" position, a mechanical interlock shall prevent opening of the unit door. This interlock shall be provided with a defeater so that authorized personnel may gain access to the compartment without interrupting service. This interlock shall also prevent unintentional closing of the disconnect when the compartment door is open. The operator mechanism design shall also allow padlocking the disconnect in the "OFF" positions with up to four padlocks.
- C. Motor starters shall be built and sized in accordance with NEMA standards for industrial control. No contactors smaller than NEMA Size 1 shall be used. The starter contactor shall be of heavy-duty construction and designed for extended electrical and mechanical operation. Minimum mechanical life expectancy for size 1 through size 5 contactor shall be 10 million operations.
- D. Each motor starter shall be provided with thermal overload relay for proper protection for T-frame and U-frame motors and shall meet NEMA Class 10 tripping characteristics. The overload relay shall be designed to provide phase failure and phase unbalance protection. It shall be ambient compensated and include an isolated normally open contact for alarm. Overload trip indication shall be provided and shall have a field adjustable tripping current range of approximately 65 percent. Overload relays shall be Siemens type 3UA.
- E. Where indicated, each starter unit shall be provided with a control transformer of sufficient size to accommodate the contactor coil burden plus all specified auxiliary devices. One leg of the 120 volt secondary circuits shall be fused using a standard 250 volt fuse. The other secondary leg shall be solidly grounded.
- F. Where specified on the drawings, auxiliary contacts and/or control relays shall be provided. Each starter shall be provided with a minimum of one (1) normally open and (1) one normally closed auxiliary contact, not including the holding circuit and alarm contacts. Where indicated, relays shall be heavy-duty general purpose type, having 115 volt 60 Hertz operating coils.
- G. Each starter shall be provided with the pilot devices indicated on the drawings. Pushbuttons, selector switches and indicating lights shall be heavy-duty oil-tight type.

PART 3 - EXECUTION

3.1 EXECUTION

- A. Install individual combination motor starters or manual motor starters in accordance with manufacturer's written instructions and applicable CEC requirements.
- B. Roof mounted individual combination motor starters or manual motor starters shall be mounted on Uni-Strut or other mounting hardware adjacent to equipment. The connection

from the individual combination motor starters or manual motor starters to the equipment shall be made with Seal Tight conduit to minimize vibration on raceway. Size per code and include a grounding conductor as required by code.

END OF SECTION 16481

SECTION 16515 - LIGHTING FIXTURES**PART I - GENERAL****1.1 GENERAL**

- A. Provide light fixtures complete including LED arrays, drivers, lamps, ballasts, sockets, housing, ceiling trim rings for special ceilings, brackets, diffusers/lenses and outlet boxes.
- B. The catalog numbers included in the description of the various types of lighting fixtures shall be basically considered to establish the type or class of the fixture with a particular manufacturer only. The fixture length, LED arrays, voltage, wattage or amps, lumens, number of lamps (if applicable), component materials, accessories, mounting type and all other features required to complete the description of the fixture based on all drawing and specification information shall be complied with regardless of whether or not the catalog number specifically includes these features. If any conflict exists between the catalog number and the description, the Contractor shall either resolve the conflict with the Architect prior to submittal of his bid or furnish the fixture to meet the intent as later interpreted by the Architect without change in contract price.
- C. Lighting fixtures shall be of types as indicated in the fixture schedule on drawings.
- D. All fixtures of one type shall be of one manufacturer and of identical finish and appearance, unless indicated otherwise on drawings.

1.02 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other specification sections and drawings for related work required to be included as work under Division Sixteen.
 - 2. General provisions and requirements for electrical work.

1.03 SUBMITTALS

- A. If requested by the architect, provide a sample of any fixture proposed as a substitution for a specified fixture. Sample fixture shall be complete with lamps, cord and plug for 120 volt operation. Fixture shall be delivered to the Engineer's office for review and shall be picked up within ten (10) working days after review comments have been received; any samples left over this time will be discarded by the Engineer. Decision of Engineer regarding acceptability of any fixture is final.
- B. Provide complete manufacturers catalog data information for each light fixture, ballast and lamp, with schedule indicating building, room and special remarks and ratings. Refer to schedule in plans.

PART 2 - PRODUCTS**2.1 BALLASTS (FLUORESCENT), DRIVERS (LED)**

- A. Fluorescent fixtures shall be equipped with ETL approved C.B.M. certified high ballasts. Ballast shall be sound rated "A". Fluorescent ballasts shall be full light output rated.
- B. LED drivers shall be UL listed and include heat sinks, dimming capability 0-10 volt, be rated for 50,000 hours minimum, 120-208-277-480 volts as shown on drawings.

2.2 LAMPS

- A. Provide lamp as specified on drawings, and shall be energy saving type except when fixture is to be dimmed, provide standard lamps.
- B. Provide LED fixtures with LED arrays, lumens and drivers per Fixture Schedule on drawings.
Temperature color shall be per fixture schedule on drawings.

2.3 LIGHT FIXTURES

- A. Lighting fixtures shall have all parts and fittings necessary to complete and properly install the fixture. All fixtures shall be equipped with lamps of size and type specified.
- B. Surface and/or wall mounted lighting fixtures shall not have any exposed chase nipples or conduit knockouts visible to view within fixture housing. Lighting fixtures mounted in continuous rows shall have chase nipples or conduit knockouts between lighting fixture housing, but shall not have visible chase nipples/conduit knockouts on the visible ends of the continuous row of lighting fixtures.
- C. Where fixture color is indicated to be selected by the Architect, provide two color chip samples for review.
- D. Recessed fixtures where noted to have attached junction box shall have a junction box permanently attached to the plaster ring so that it is accessible when the fixture is removed. Connection between fixture and pull box to have flexible conduit and 2 #12, 1#12 ground AWG minimum "AF" wires. The flexible conduit to be sufficient length so that when the fixture is dropped, the pull-box is readily accessible.
- E. Recessed fixtures must all have Underwriters' Laboratory approval for recessed installation with plaster frame and attached pull box. Lamp enclosure, reflectors and finish wiring shall not be installed until plastering is completed. Finish trim shall not be installed until finish painting of the adjacent surface is completed.
- F. The fixture to bear Underwriters' label of approval for the wattage indicated.
- G. Light fixtures installed outdoors in damp or wet locations shall be U.L. labeled for said location.

2.4 LENS AND DIFFUSERS

- A. Diffusers shall be formed from cast sheet having a minimum unpenetrated thickness of

0.125" and, in any event, shall be of sufficient thickness and or proper construction and camber to prevent the diffusers from having any noticeable sag over the entire normal life of the installation.

- B. Acrylic lenses shall be manufactured from 100% acrylic as manufactured by Rohm & Hass, called Plexiglas V, V Type 920, VM, or an approved equal by either injection molding or by extraction.

PART 3 - EXECUTION

3.1 LIGHT FIXTURE MOUNTING HARDWARE

- A. It is the Contractor's responsibility to verify actual ceiling construction type as defined on the architectural drawings and furnish all lighting fixtures with the correct mounting devices and proper operating voltage whether or not such variations are indicated by fixture catalog number. The Contractor shall verify depth of all recessed lighting fixtures with architectural drawings prior to ordering fixtures. Any discrepancies that would cause recessed lighting fixtures not to fit into ceiling shall be reported to the Architect prior to ordering of the fixtures.
- B. Recessed fixture mounted flush in "lay-in" T-bar or concealed spine ceilings shall be provided with two clips on each end of the fixture and connected to the ceiling cross runners. Provide two 12-gauge fixture hanger wires attached to structural members and connect to diagonal corners of the fixture. Fixture shall set level and flush with ceiling grid system.
- C. Surface mounted fixtures mounted to a suspended "tee" ceiling shall be installed with a one and one-half inch steel channel or angle which spans across and above the main runners. The channel or angle member shall be provided with threaded studs for attaching to the fixture housing through the lay-in tile. Two members shall be installed per four foot fixture. Two 12-gauge hanger wires shall be provided per member, attached 6" from each end of the member and anchored to the structure above.
- D. Pendant mounting fixtures shall be supplied with swivel hangers. Fixture shall swing in any direction a minimum of 45 degrees of gravity, position. Fixtures shall have special stem lengths to give the mounting height indicated on the drawings. Stem to be 1-piece without coupling and to be finished the same color as the canopy and the fixture, unless otherwise noted. The Contractor shall check all lock-nuts and set screws to rigidly secure the socket to the stem, and the stem to the outlet box. Fixtures shall be installed plumb and vertical. Where obstructions occur, restricting 45 degrees swing of fixtures, the fixtures shall be guy wired to prevent fixtures from striking obstructions. Method of guying shall be approved by the Architect and Electrical Engineer. Swinging fixtures shall have a safety cable attached to the structure and the fixture at each support capable of supporting four times the vertical load.
- E. Suspended fixtures weighing in excess of 50 pounds shall be supported independently of the fixture outlet box. Provide "aircraft" hanger cable for suspended fixtures route cable concealed or in pendant where possible. Each cable shall support four times the weight of the fixture. Securely attach the cable to the building structure.
- F. On acoustical tile ceilings, fixture outlets shall be accurately located in the center, at the intersection of the four corners or at the center of the joints of two tiles.
- G. Surface mounted fixtures installed on drywall or plaster ceilings and weighing less than 50 pounds may be supported from outlet box. Provide structural supports above drywall or plaster ceilings for installation of fixtures weighing more than 50 pounds and secure fixture

to structural supports. The use of toggle bolts is prohibited.

- H. The electrical Contractor shall aim the exterior adjustable lighting fixtures after dark in the presence of, and at a time convenient to the Architect.

3.2 RECESSED LIGHTING FIXTURES

- A. Lighting fixtures recessed in ceiling or wall which has a fire resistive rating of 1 hour or more shall be enclosed in a box which has a fire rating equal to that of the ceiling or wall. The space from the fixture to the enclosure to be a minimum of 3" and the light fixture shall be IC rated.

3.3 LAMPS

- A. Fluorescent lamps controlled by dimming equipment shall be operated (aged) for 100 continuous hours without interruption, at 100% output prior to occupancy of the building by the Owner.
- B. Energy saving fluorescent lamps shall not be used in dimming systems.

3.4 LENS AND DIFFUSERS

- A. Lens and diffusers shall be completely cleaned of all dust, dirt and fingerprints after the installation of the light fixtures, ceiling, painting, lamps, and prior to occupancy of the facility by the Owner.

3.5 BALLASTS

- A. Ballasts remote from the lighting fixture, mounted as shown on the drawings and designed for remote operation. Additional wiring and conduit shall be provided whether shown on the drawing or not, between lighting fixture and remote ballasts with required quantity of "THHN" wire to operate said fixture(s).
- B. Provide proper type and quantity of conductors with conduit system for proper operation of dimming system, whether or not shown on drawings.
- C. Contractor shall tandem wire (1) one lamp or (3) three lamp fluorescent fixtures when fixture is recessed mounted and within (8) eight feet of each other or if surface or pendant mounted within (1) one foot of each other. To accomplish tandem wiring, a tandem wiring harness shall be installed between inboard master ballast and inboard slave lamp located in adjacent fixture. Night light or emergency light fixtures shall not apply.

END OF SECTION 16515