PROJECT MANUAL FOR:

AUGUST 2, 2019

11th Street Apartments

Augusta, Georgia

HPA #2018564

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11th Street Apartments
PROJECT MANUAL SPECIFICATIONS

Section Title

NOTE: Specifications provided in this manual are for Vertical Construction.

PROJECT MANUAL DATED 08/02/2019 –Draft

BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT

DIVISION 1 GENERAL REQUIREMENTS

DIVISION 2 EXISTING CONDITIONS

NOT USED

DIVISION 3 CONCRETE

DIVISION 4 MASONRY

DIVISION 5 METALS

SECTION 010100

SUMMARY OF WORK

PART 1- GENERAL

1. 1 SUMMARY

A. Section Includes:
   1. Contractor use of site and premises.

B. Scope of work – Architectural
   1. **11th Street Apartments** consists of:
   155 Residential Units and an approx. 7,000 GSF Clubhouse/Leasing Office, with Fitness, Parcel/Mail. The project consists of (2) two residential buildings that are (4) four Story each Building. The Buildings are all wood frame construction with on a conventional concrete foundation system with a conventional truss roof and flat, membrane roof mix, covered parking and surface parking. The project also includes a separate, Maintenance/Storage Garage, a Trash Compactor enclosure, Dog walk and Spa and a Swimming Pool.
   2. The work will be constructed under a single prime contract

C. Scope of Work Civil and Landscape/Hardscape
   1. Scope consists of work as indicated on the civil engineering and landscape/hardscape contract drawings and the contract specifications provided herein.
   2. Scope of work includes but is not necessarily limited to the following:
      Grading and Erosion Control
      Utility Construction
      Street Construction

1.2 CONTRACTOR'S USE OF SITE AND PREMISES

A. Limit use of site and premises to allow for:
   1. Work by separate contractors.
   2. Work by Owner.

B. Coordinate use of site and premises with the Owner.

C. Move any stored products under Contractor's control, which interfere with the operations of the Owner or separate contractors.

E. Assume full responsibility for protection and safekeeping of products under this Contract stored on site.

F. Obtain and pay for use of any additional storage or work areas needed for operations.

G. WORK HOURS:
   1. No work shall be done between 6:00 P.M. and 7:00 A.M. nor on Sundays or legal holidays, without the approval of the OWNER or the Engineer. However, work necessary for emergencies or for the protection of equipment or finished work may be done as required.

1.3 PARTIAL OWNER OCCUPANCY

A. The Owner reserves the right to occupy and to place and install equipment in completed areas of the site and buildings prior to final Completion. Placing equipment and partial occupancy do not constitute acceptance of the Work.

   1. The Architect will prepare a Certificate of Substantial Completion for each portion of the Work occupied prior to Owner Occupancy.

2. Prior to issuance of the Certificate of Substantial Completion the Contractor shall obtain a Certificate of Occupancy from Building Officials prior to Owner Occupancy.

3. Prior to issuance of the Certificate of Substantial Completion for partial occupancy, the Contractor shall assure that Mechanical and Electrical systems are operational and all required inspections and tests are completed for that portion. Owner shall operate and maintain systems for completed and accepted portions. Owner shall be responsible for maintenance and custodial services for completed and accepted portions of the building.

PART 2 - PRODUCTS

Not used.

PART 3- EXECUTION

Not used.

END OF SECTION

SECTION 010410

PROJECT COORDINATION

PART I – GENERAL

1.1 SUMMARY

A. This section shall not be interpreted to relieve Contractor of his sole responsibility for supervision and coordination of all construction procedures as provided herein and in Contract Conditions.

B. Contractor Requirements:

1. Be responsible for supervising and directing work, using his best skill and attention.
2. Be solely responsible for all construction means, methods, techniques, sequences and procedures, and coordination of all portions of Work under Contract.
3. Be responsible for acts and omissions of his employees, subcontractors and their agents, employees.

C. Contractor shall not be relieved from his obligation to perform Work complying with Contract Documents, either by activities of Architect in his administration of Contract, as described in section 2.2 of the General Conditions or by inspections, tests or approvals required to substantiate Contract compliance.

D. Provisions of this section are considered minimal for orderly and expeditious prosecution of Work.

E. Related sections:

1. Section 01200: Project Meeting
2. Section 01300; Submittals
3. Section 01310; Progress Schedules
4. Section 01410; Testing Laboratory Services
5. Section 01615; Delivery, Storage, and Handling
6. Section 01630; Product Options and Substitutions
7. Section 01700; Contract Closeout
8. Section 01705; Cleaning Up

1.2 PROJECT COORDINATION

A. Coordinate scheduling, submittals, and work of various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.

C. Coordinate space requirements and installation of mechanical and electrical items which are indicated diagrammatically on Drawings. Follow routing shown as closely as practical; place runs parallel with building lines. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean up of work of separate Sections in preparation for Substantial Completion. Maintain site and construction areas daily to avoid possible fire hazard or danger to others.

F. After Owner occupancy, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents to minimize disruption of Owner's activities.

1.3 ORDERING PRODUCT

A. Before ordering materials, equipment, custom or standard fabricated items, verify the

Following provisions:

1. Each item complies with Contract Documents.
2. Each property relates to Work already completed.
3. Shop drawings or other submittals confirm "1" and "2" above.
4. Orders are placed and delivery dates are established allowing orderly execution of Work on schedule and not allowing untimely delivery of critically sensitive products before Project site conditions are satisfactory to receive them.

B. Prints and Specifications:

1. Owner to supply Contractor with ten sets of final construction prints and specifications along with one reproducible set of drawings.
2. Owner to supply Contractor with one reproducible drawing of all major changes.

1.4 COORDINATION AMONG TRADES:

A. Initiate coordinating procedures at Project meetings before work in field begins. Resolve scheduling, sequencing, interference's, and priorities of oncoming simultaneous Woork among interested parties to achieve specified results, and to advance planned progress of Project.

B. The General Contractor shall also be responsible for the following coordination functions:

1. Power: Electrical company shall bring electrical service to the site. Electrical subcontractor shall be required to make all necessary connections to this work as indicated or required to make all necessary connections to this work as indicated or required by drawings and to pay all fees, charges and costs of any nature whatsoever to provide the electrical service.
2. Water: Plumbing subcontractor shall be required to make all necessary connections as indicated on drawings for each unit and meters for all residential units, common areas, clubhouse, etc.
3. Sanitary Sewer: Plumbing subcontractor shall be required to make all necessary connections as indicated on drawings.
4. Site Drainage: Contractor shall be required to make all necessary connections as indicated on drawings.
5. Roadway Improvements: Contractor shall be required to make all roadway improvements as indicated on drawings or as required to satisfy job field conditions.
6. Telephone: Phone company shall bring telephone service into job site as indicated on drawings. Exact location of conduit stubout shall be verified with Telephone Company.
7. Other Utilities: Contractor shall make necessary arrangements to provide all other utilities required as may be referred to on drawings or these specifications.
8. Gas: Gas subcontractor shall be required to make all necessary connections as indicated on drawings for each unit, clubhouse, spa heaters, pool heater and gas grilles, etc.

C. Continue coordinating procedures by actively controlling Project conditions as follows:

1. Verify products of all trades are stored in orderly fashion under conditions complying with manufacturer's instructions or specific requirements of relevant specification section whichever requirement is more stringent at planned locations.
2. Verify compliance with environmental conditions before, during and after execution of Work, with manufacturer's instructions and specific requirements of relevant sections of these specifications.
3. Verify adherence to specified tolerances as work progress.
4. Inspect job conditions before one trade follows another in compliance with these specifications:
    a. Plan joint inspections involving interested parties.
    b. Portions of these inspections may be observed by Architect.
    c. Architect will confine his observations to only limited areas; Contractor shall be responsible for continuing similar inspections to all areas involved.

d. Review of job conditions, in part, or in whole, by Architect in no way relieves Contractor of his obligation to provide various stages of Work as well as finished Work complying with Contract Documents.

e. Allow no Work to proceed over unsatisfactory conditions which would prevent execution of new Work as specified.

f. Coordinate and work with Owner's representative.

D. Continue coordinating efforts as Work progresses, verifying parties comply with decisions as agreed under paragraph 1.03 A, B and C above. Make adjustments in planned procedures as changing job conditions required to achieve results specified to best advance progress of Work. Immediately advise all parties involved of required changes in construction schedule and planned procedure.

1.5 COORDINATION WITH RELATED WORK

A. Require all trades to cooperate with related Work as well as with those sections enumerated in 1.01 E above.

B. Contractor and his subcontractors: Coordinate Work with separate contract work by Owner, if applicable, and with prior occupancy required by Owner. Owner will provide timely notice of planned occupancy.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 010450

CUTTING AND PATCHING

PART 1 - GENERAL

1. 1 SUMMARY

A. Section includes:
   1. Requirements and limitations for cutting and patching of new work.

B. Execute cutting to include excavating, fitting, and patching of Work required to:
   1. Make several parts fit properly.
   2. Uncover work to provide for installation of ill-timed work.
   3. Remove and replace defective work.
   4. Remove and replace work not conforming to requirements of Contract Documents.
   5. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

1.2 SUBMITTALS

A. Submit written request in advance of executing cutting or alteration which affects:
   1. Work of Owner, Contractor or other Subcontractor.
   2. Structural integrity of project.
   3. Integrity or effectiveness of weather exposed or moisture resistant elements or systems.
   4. Efficiency, operational life, maintenance, or safety of operational elements.
   5. Visual qualities of sight exposed elements.

B. Include in Request:
   1. Identification of project.
   2. Description of work affected.
   3. Necessity for cutting or patching.
   4. Effect of cutting or patching on work of Owner, Contractor, or other Subcontractors, or on structural, weatherproof, or visual integrity of project.
   5. Description of proposed work:
      a. Scope of cutting and patching.
      b. Trades to execute work.
      c. Products proposed to be used.
      d. Extent of refinishing.
   6. Alternate to cutting and patching.
   7. Cost proposal, if applicable.
   8. Written permission of any separate contractor whose work will be affected.

C. If conditions of work or schedule necessitate a change of material from that originally installed, submit written request in accordance with Section 01600.

D. Submit written notice to Contractor designating timework will be uncovered, to allow for observation.

1.3 PREPARATION

A. Examine existing conditions of work, including elements subject to movement or damage during cutting and patching.

B. After uncovering work, examine conditions affecting installation of new products or performance of work.

C. Provide protection for other portions of project.

D. Provide protection from elements.

1.4 CUTTING AND PATCHING

A. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.
B. Execute cutting and demolition by methods, which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs and new work.
C. Execute excavating and backfilling by methods which will prevent damage to other Work, and will prevent settlement.
D. Employ original installer or fabricator to perform cutting and patching for:
    1. Weather exposed or moisture resistant elements.
    2. Sight exposed finished surfaces.
E. Restore work which has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.
F. Refinish entire surfaces as necessary to provide an even finish:
    1. Continuous surfaces: To nearest intersections.
    2. Assembly: Refinish entirely.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 010500

FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Survey and field engineering.
   2. Submittals.
   3. Records.

B. Owner has provided (or will provide) Contractor with a survey for the property. Contractor shall provide all surveys and layouts required for the performance of the work. Owner's surveyor will locate property corners and provide a benchmark. Owner's engineer will provide building coordinates to the Contractor. Contractor shall provide a complete ALTA as-built survey including, but not limited to, the location of all buildings, roads, utilities and all surface structures in reproducible form and a complete 2 sets of as-built plans signed, sealed and certified as Owner requests.

1.2 QUALIFICATIONS

A. Surveyor: Qualified engineer or land surveyor selected by the Contractor and licensed in the State in which project is located.

1.3 SUBMITTALS

A. Submit documentation to verify accuracy of field engineering work upon Owner or Architect's request.

B. Submit certification that elevations and locations of improvements are in conformance with Contract documents.

C. Submit Foundation Survey in compliance with Lender requirements

1.4 SURVEY REFERENCE POINTS

A. Existing horizontal and vertical control points for project are those designated on Engineering Documents.

B. Locate, verify and protect control points prior to beginning Work; preserve permanent reference points during construction.

1.5 PROJECT SURVEY REQUIREMENTS

A. Contractor will establish minimum of two permanent benchmarks on site, referenced to survey control points. Subcontractor shall protect marks and record locations on Project Record documents.

B. Establish lines and levels, locate and lay out, by instrumentation:
   1. Site improvements:
      a. Stakes for grading, fill and topsoil placement.
      b. Utility slopes and invert elevations.
   2. Building foundation locations, floor elevations and other controlling dimensions.
   3. Controlling lines and levels required for mechanical and electrical trades.

C. Perform the following:
   1. Verify existing grades prior to beginning site preparation. Notify Architect and Owner if existing grades are at variance with the drawings; awaits instructions prior to proceeding.
   2. Verify limits of site preparation and earthwork operations. Locate appurtenances, trees to remain, and existing pavements.
   3. Establish benchmarks outside building lines.
   4. Verify locations and levels of buildings and appurtenances; include structural and facing components. Note variation from indicated locations and levels.

5. Verify batter boards at building corners.
6. Verify utility locations, including new construction and existingactive and inactive encountered during construction activity.
7. Verify outside building lines to ensure correct position of buildings and appurtenances on Project site. Make required surveys to fix and verify foundation locations and elevations, column centerlines, walls, trenches, etc.
8. Measure settlement of building during construction operations.

D. Promptly notify Architect/Owner of any errors or discrepancies noted; await instructions prior to proceeding with Work.
E. During course of Work, prepare log containing all data observed as result of field engineering. Maintain log for reference by Owner and Architect.
F. Notify Owner/Architect promptly in writing of on-site conditions at variance with Contract Documents.

1.6 RECORDS

A. Maintain accurate log of control and survey work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 010900

REFERENCE STANDARDS

PART I - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Quality assurance.

1.2 QUALITY ASSURANCE

A. For products or workmanship specified by reference to association, trade, or industry standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

C. Conform to edition of reference standard in effect as of date of Project Manual.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

E. In the absence of a specific detail or specification reference, it is required that the contractor notify the architect in writing, requesting specific guidance. When no written request is presented then building code requirements, association, trade or industry standards shall be the appropriate minimum reference standard.

1.3 SCHEDULE OF REFERENCES

A. References are made in these specifications to the following:

ASTM Standards as referenced by the International Building Codes
Standards as referenced by the National Electrical Code

It is the Contractor's responsibility to obtain these specifications. Fees as listed are subject to change.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 012000

PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Contractor requirements include:
   1. Schedule and administer preconstruction meeting, weekly progress meetings with subcontractors in attendance, and specially called meetings throughout progress of work.
   2. Prepare agenda for meetings.
   3. Distribute written notice of each meeting in advance of meeting date.
   4. Make physical arrangements for meetings.
   5. Preside at meetings.
   6. Record minutes; include significant proceedings and decisions.
   7. Reproduce and distribute copies of minutes within three days after each meeting as follows:
      a. One copy to each participant in meeting.
      b. One copy to parties affected by decisions made at meeting.
      c. One copy of minutes to Architect and Owner.

B. Representatives of contractors, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. Architect and Owner may attend meetings to ascertain Work is expedited consistent with Contract Documents and construction schedules.

D. Related sections:
   1. Section 01040: Coordination
   2. Section 01300: Submittals
   3. Section 01310: Progress Schedules

1.2 PRE-CONSTRUCTION MEETING:

A. Occurs at Start of Construction on Project Site

B. Attendance:
   1. Owner's Representative
   2. Architect and professional consultants
   3. Resident Project Representative
   4. Contractor's Superintendent
   5. Major Subcontractors
   6. Others, as appropriate

C. Suggested agenda:
   1. Distribution and discussion of :
      a. List of major subcontractors and suppliers
      b. Projected Construction Schedules
   2. Critical work sequencing
   3. Major deliveries and priorities
   4. Project coordination: Designation of responsible personnel
   5. Procedures and processing of :
      a. Field decisions
      b. Proposal requests
      c. Submittals
      d. Change Orders
      e. Applications for Payment
   6. Adequacy of distribution of Contract Documents

7. Procedures for maintaining Record Documents
8. Use of Premises:
    a. office, work, and storage areas
    b. Owners requirements
9. Construction facilities, controls, and construction aids
10. Temporary utilities
11. Safety and first-aid procedures
12. Security procedures
13. Housekeeping procedures

1.3 PROGRESS MEETINGS:

A. Schedule weekly meetings.
B. Hold called meetings as required by progress of Work.
C. Schedule pay application meetings once a month involving the construction lender's representative to review the previous month's pay application, the progress schedule, manpower requirements, etc.
D. Location of meetings: Project field office of Contractor.
E. Attendance:
    1. Architect, Owner, and professional consultants as needed.
    2. Subcontractor, as appropriate to agenda.
    3. Suppliers, as appropriate.
    4. Others.
F. Attendance:
    1. Review, approval of minutes of previous meeting.
    2. Review of work in progress since previous meeting.
    3. Field observations, problems, and conflict.
    4. Problems which impede Progress Schedule.
    5. Review off-site fabrication, delivery schedules.
    6. Corrective measures and procedures to regain projected schedule.
    7. Revisions to Progress Schedule.
    8. Progress; schedule, during succeeding work period.
    9. Coordination of schedules.
    10. Review submittal schedules; expedite as required.
    11. Maintenance of quality records.
    12. Pending changes.
    13. Review proposed changes for effect on:
        a. Progress schedule and on completion date.
        b. Other contracts of Project.
    14. Review and approval of monthly pay applications.
    15. Other business.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Submittals Schedule and Application for Payment forms with Continuation Sheets (AIA Document G703 Continuation Sheet).
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than 7 days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Indicate the scheduled value of major categories and subcontracts for the Work.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Owner's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Change Orders (numbers) that affect value.
      d. Dollar value: Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide several line items for principal subcontract amounts, where appropriate.
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
   7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
      a. Identify temporary facilities and other major cost items that are not direct cost of actual work-in-place as either separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
   8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. General:
   1. Each Application for Payment shall be consistent with previous applications, except as otherwise required herein, and payments as certified by Architect and paid for by Owner.
   2. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor, or, if not indicated, the 15th day of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days before the date for each progress payment.
   3. Payment Application Forms: AIA Document G702 and AIA Document G703 Continuation Sheets.
   4. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
      a. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
      b. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

B. Transmittal: Submit 4 signed and notarized original copies of each Application for Payment to Architect. All copies shall include waivers of lien and similar attachments if required.
   1. Transmit with a transmittal form listing attachments and recording appropriate information about application.

C. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

D. Initial Application for Payment: Include the following administrative actions and submittals prior to, or with, submittal of first Application for Payment:
   1. List of subcontractors.
   2. Schedule of Values.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Submittals Schedule (preliminary if not final).
   5. List of Contractor's staff assignments.
   6. Copies of building permits.
   7. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   8. Certificates of insurance and insurance policies.
   9. Performance and payment bonds.
   10. Data needed to acquire Owner's insurance.

E. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. Application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

F. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, the following:
1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9.

PART 2 - PRODUCTS

PART 3 - Not Used
1.

PART 4 - EXECUTION

PART 5 - Not Used

END OF SECTION

SECTION 013000

SUBMITTALS

PART 1- GENERAL

1.1 SUMMARY

A. General Provisions:

1. Provisions in this section are mandatory procedures for preparing and submitting samples, shop drawing, product data, manufacturer's instructions, and manufacturer's certificates.
2. Provide submissions in orderly sequence; time to cause no delay in work.
3. Job delays occasioned by requirement of resubmission of samples, shop drawings, and product data not in accord with Contract Documents are Contractor's responsibility, and will not be considered valid justification for extension of time.
4. Beginning any portion of Work requiring submittals to the Architect, until the Architect has reviewed submittal, is prohibited.
5. Shop Drawings submittal and review process for the Project shall conform to guidance published in attached sheet.

B. Submittal Schedule:

1. Submit proposed submittals schedule to Owner and Architect for review within thirty calendar days following Contract execution.
2. Schedule purpose is to:
   a. Demonstrate that submittals, shop drawings, data, samples and mock-ups required for Work are addressed by Contractor.
   b. Demonstrate consistency with Contractor's proposed Progress Schedule.
   c. Assist Owner in scheduling timely review/approval action of submittals.
3. Schedule contents: Description of submitted item, proposed date of submittal or availability for review, and proposed date of requested return.
4. Within ten calendar days after Architect's receipt of submittal schedule, Architect, Owner, and Contractor shall jointly review schedule and mutually agree to acceptability or necessary modifications.
5. Submit accepted schedule within ten calendar days after joint review date.

1.2 DEFINITIONS:

A. Terms:

1. Product Data: Dated, printed literature of product manufacturer which describes product and installation procedures.
2. Samples: Physical examples prepared to illustrate materials, equipment, or workmanship; to establish standards by which Work will be judged as complying with contract requirements.
3. Shop Drawings: Drawings, diagrams, illustrations, schedules, and performance charts, prepared to illustrate a portion of work in detail.
4. Submittals: General term including samples, shop drawings, and product data, as applicable.

1.03 SAMPLE PREPARATION:

A. Prepare samples in sizes, shapes, and finishes in accord with provisions of individual specification sections.

B. Number of samples submitted: Total required by Contractor to be returned, plus one, which will be retained by Architect, and one which will be retained by the Owner. unless otherwise indicated.

C. Samples requiring color selection: Submit at earliest practical time.

1.04 SHOP DRAWING PREPARATION:

A. Conform to the following requirements:

1. All shop drawings to be reviewed by Contractor and signed and dated prior to submission to Architect.
2. Number sheets consecutively.
3. Indicate working and erection dimensions and relationships to adjacent work.
4. Indicate:
   a. Arrangements and sectional views, as applicable.
   b. Material, gauges, thickness, finishes, and characteristics.
   c. Anchoring and fastening details; include information for making connections to adjacent work.
5. Indicate working and erection dimensions and relationships to adjacent work. Concurrent submittals of different aspects of work may be required as deemed necessary to demonstrate Contractor's ability to understand these relationships and coordinate work.
6. Provide 6" x 6" clean space in the lower right hand area for entry of the approval stamps.
7. Cross-reference drawing details and specification paragraphs applicable to submitted data.

B. Submit six sets of information and or prints of shop drawings to Architect and one to Owner's representative.

1.5 PRODUCT DATA PREPARATION

A. Include product manufacturer's standard printed material, dated, with product description and installation instructions indicated; delete data not related to this Project or mark "VOID" as applicable; the Architect will keep one or two copies for his hand records, return two copies to the Contractor and one to the Owner's representative.

1.06 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, in quantities specified for Product Data.
B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.07 MANUFACTURER'S CERTIFICATES

A. When specified in individual Specification Sections, submit manufacturers' certificate to Contractor, in quantities specified for Product Data.
B. Indicate that material or Product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Contractor.

1.8 CONTRACTOR'S REVIEW:

A. Review submittals and stamp with approval action stamp containing Contractor's name, word "Approved", signed initials of approving agent, date of approval action, review notes, comments and corrections as required prior to submission. By so noting, Contractor indicates that he has reviewed and approves materials, equipment, quantities, and dimensions represented by particular submittal.
B. Determine and verify field measurements, field construction, materials, catalog numbers, and similar data. Check and coordinate each submittal with requirements of Work and Contract Documents.
C. Where Work is indicated "BY OTHERS," indicate responsibility for providing and coordinating such work.
D. Contractor after submittals processed are not Change Orders; purpose of submittals by Contractor is to demonstrate Contractor understands design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing fabrication and installation methods he intends to use.
E. Contractor represents by submitting samples, shop drawings, and product data that he has complied with provisions specified above. Submissions made without Contractor's approval indicated thereon will be returned without being reviewed for compliance with this requirement.
F. Date each submittal; indicate name of Project; Owner, Contractor, Subcontractor, as applicable, description or name of equipment, material, or product and identity Work use location.

G. Accompany submittal with transmittal letter containing project name, Contractor's name, number of samples or drawings, titles, and other pertinent data. Outline deviations, if any, in submittals from requirements of Contract Documents.
H. Direct specific attention, in writing, on transmittal and resubmitted shop drawings, product data, or samples, to revisions other than those requested by Architect or Owner on previous submittals.

1.9 ARCHITECT'S REVIEW:

A. Review submittals with reasonable promptness to cause no delay in Work. Contractor shall allow 10 working days for Architects review of all submittals.
B. Review is only for conformance with design concept of project and information in Contract Documents. Review of separate items shall not indicate approval of assembly in which item functions.
C. Review of Submittals shall not relieve Contractor of responsibility for any deviation from requirements of Contract Documents unless Contractor has informed Owner in writing of such deviation at time of submission and Owner has given written approval to the specific deviation or in no way relieve Contractor from responsibility for errors or omissions in submittals.

1.10 RESUBMISSION:

A. Make corrections and changes indicated for unproved submissions; resubmit in same manner as specified above until approval is obtained.
B. Direct specific attention to revisions other than corrections requested on previous submissions, if any, in resubmission's transmittal.

1.11 DISTRIBUTION:

A. Contractor is responsible for obtaining and distributing copies of submittals to his sub-contractors and material suppliers. Make prints of reviewed shop drawings from transparencies, which carry appropriate stamp.
B. Maintain orderly file of all approved submittals bearing approval stamp for Project duration.

PART 2 - PRODUCTS

2.1 OWNER TO REVIEW AND APPROVE:

A. Electric and Plumbing Fixtures – Model/Style/Finish
B. Tub and showers
C. Stucco and texture
D. Shutter; Style and Color
E. Windows, Interior and Exterior Doors and all Trim; Style and Color
F. Millwork; Standing and Running Trim
G. Interior and Exterior Paint; Finish, Color and Sheen.
H. Appliances
I. Cabinets
J. Counters
K. HVAC Equipment
L. Bath Accessories
M. Hardware Style and Finish
N. Flooring Style and Finish
O. Elevator Finish Selections

PART 3 – EXECUTION

Not used.

END OF SECTION

Shop Drawing Submittal and Review Process

Hard Copy Submittal Process:

1. Submit a minimum of 7 copies or the number of copies required to be returned to the subcontractor and/or supplier plus 3 additional copies. Distribution is as follows:
   a. Owner 1 copy
   b. HPA 6 copies (includes 1 copy for HPA, 1 copy for consultant, 4 copies returned)

2. HPA will review, log in and number the submittal.

3. HPA forwards MEP submittals to MEP Consultant. HPA forwards structural submittals to Structural Consultant.

4. HPA tracks consultant review period and follows up as needed.

5. HPA receives comments from Owner and incorporates any comments into submittal or processes the submittal with notation "Final Approval by Owner". HPA receives comments from MEP or Structural Consultant and logs response. HPA supplements review as appropriate.

6. HPA prepares shop drawing process cover sheet and forwards completed packages back to General Contractor.

7. General Contractor. to provide (1) one hard copy of completed, reviewed submittal packages to Owner

Electronic Submittal Process:

1. Following Contractor Review, General Contractor shall prepare an electronic shop drawing package. Package shall have General Contractor Shop Dwg review stamp and date on first page or cover sheet. General Contractor shall electronically transmit package to Architect and Owner (or to Structural or MEP consultant as appropriate with Architect Approval).

2. HPA will log in and number the submittal.

3. HPA will monitor review process for MEP submittals with MEP Consultant and Structural submittals with Structural Consultant.

4. HPA tracks consultant review period and follows up as needed.

5. HPA receives comments from (Owner) and incorporates any comments into submittal or processes the submittal with notation "Final Approval by Owner". HPA receives comments from MEP or Structural Consultant and logs response. HPA supplements review as appropriate

6. HPA prepares shop drawing process cover sheet and forwards completed packages back to General Contractor.

7. General Contractor to transmit (1) one electronic copy of completed, reviewed submittal packages to Owner

It is anticipated that this process will take from 5-10 working days. If there are special "time sensitive" requirements for individual submittals, please identify as such. We can work through some special circumstances as needed.. and/or can allow shipping Structural Packages or MEP Packages directly to the Consultant with approval.

NOTE: Site Related Civil Engineering packages may go directly to Civil Engineer. They do not need to be part of the process described herein.

SUBSTITUTION REQUEST FORM

DATE: _____
Architect's Project No: _____

Project: _____

To: _____ From: _____

_____ _____

_____ _____

==========

Contractor (Bidder) hereby request acceptance of the following product or system as substitution in accordance with provisions of Section 01600 of the Specifications:

1. SPECIFIED PRODUCT OR SYSTEM:

   Substitution request for : _____

   Specification Section No : _____ Article: _____

2. SUPPORTING DATA:

   _____ Product data adequate for evaluation of the request for proposed substitution is attached (description of product, reference standard, performance and test data, specifications, drawings, photographs).

   _____ Sample is attached.

   _____ Sample will be sent if requested.

3. QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION
Name, Brand:	_____	_____
Catalog No.:		_____
		_____
Manufacturer:		_____
		_____
Vendor:		_____ _____
Significant Variations:		_____ _____

(Add Additional Sheets If Necessary)

Maintenance Service Available: Yes _____ No _____

Spare Parts Source: _____

Warranty Provided: Yes _____ No _____ Years _____
By Whom: _____

4. PREVIOUS INSTALLATIONS:
Identification of similar projects on which proposed substitution was used:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

5. REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS:

_____

_____

_____

6. EFFECT OF SUBSTITUTION:
Does the proposed substitution affect other work (adverse or otherwise):
No _____ Yes _____ (if yes, explain)

_____

_____

_____

_____

Substitution Changes Contract Time: No _____ Yes _____
Add/Deduct _____Days

Substitution requires dimensional revisions or redesign of the work: No _____ Yes _____ (if yes, attach explanation data)

Saving of credit to Owner: $ _____

Extra Cost to Owner: $ _____

7. CONTRACTOR'S (BIDDER'S) STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT DOCUMENTS:

I/we have investigated the proposed substitution. I/we:

- believe that it is equal or superior in all respects including function, appearance and quality to specified product, except as stated above;
- will provide same warranty and servicing requirements as specified for specified product;
- have included complete cost data and implications of the substitution;

- will pay for changes to the building design and special inspection costs caused by the use of this product;
- will coordinate the incorporation of the proposed substitution in the work;
- waive future claims for added cost to Contract caused by the substitution.

Contractor (Bidder): _____

Date: _____ By: _____
Answer all questions and complete all blanks - use "NA" if not applicable. Unresponsive or incomplete request will be rejected.

==========

ARCHITECT'S REVIEW AND ACTION

_____ Resubmit substitution request

_____ Provide more information in the following areas:

_____

_____

_____ Sign Contractor's (Bidder's) Statement of Conformance

_____ Substitution is accepted.

_____ Substitution is accepted, with the following comments:

_____

_____

_____ Substitution rejected.

_____ Substitution Request received too late.

_____ Date: _____
Architect

SECTION 013100

PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements: **Prior to** award of Contract, prepare and submit to Owner estimated construction progress schedules for work, with subschedules of related activities, which are essential to its progress.

B. Related sections:
   1. Conditions of the Contract
   2. Section 013000: Submittals
   3. Section 017000: Contract Closeout

1.2 BAR CHART SCHEDULE FORM - ADDITIONAL

A. Prepare schedules in the form of a horizontal bar chart with dependencies.
   1. Provide separate horizontal bar for each trade or operation.
   2. Horizontal time scale: Identify the first work day of each week.
   3. Scale and spacing: To allow space for notations and future revisions.

B. Format of listings: The chronological order of start of each item of Work.

C. Identification of listings: By major specification section numbers.

1.3 SCHEDULE CONTENT

A. Progress schedule. Indicate the following:
   1. Complete sequence of construction by activity.
   2. Dates for beginning and completion of each major element of construction.
   3. Major milestones.

B. Products delivery schedule: Indicate delivery dates for Products.

C. Provide sub-schedules to define critical portions of prime schedules.

1.4 PROGRESS REVISIONS

A. Indicate progress of each activity to date of submission.

B. Show changes occurring since previous submission of schedule:
   1. Major changes in scope.
   2. Activities modified since previous submission.
   3. Revised projections of progress and completion.
   4. Other identifiable changes.

C. Update progress schedule monthly.

1.5 SUBMISSIONS:

A. Submit initial schedules **prior to execution of Contract**. Owner will review schedules and return review copy within 10 days after receipt. If required, resubmit within seven days after return of review copy.

B. Submit five opaque reproductions.

1.6 DISTRIBUTIONS

A. Distribute copies of reviewed schedules to job site file, subcontractors, and other concerned parties.

B. Instruct recipients to report promptly to Contractor, in writing, any problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 013800

CONSTRUCTION PHOTOGRAPHS

PART I - GENERAL

1.1 SUMMARY

A. Provisions in this section are mandatory procedures for preparing and submitting construction photographs.

1.2 PHOTOGRAPH PREPARATION

A. Engage a commercial photographer to take color aerial photographs to show progress of Work.
B. Take photographs on monthly basis. Schedule photography to allow submittals of photographs with Contractor's monthly application for payment.
C. Take photographs beginning at first month of construction activity and terminating at Date of Final Acceptance.
D. Take photographs on same day each month, weather permitting, and at same time of day.
E. Three exposures will be selected from which photographs will be taken. Take photographs from same location each month, unless directed otherwise.

1.3 PHOTOGRAPHS SUBMITTAL:

A. Submit photographs with Contractor's Application for Payment.
B. Individual photograph requirements are as follows:
    1. Size: 8"x10", color, glossy finish.
    2. Print on single weight paper.
    3. Quantity: Four prints of each view.
C. Label back of each photograph with Project name, date, description of location or element of Work, and Contractor's name.
D. Provide Electronic Copy of Each Month's Photographs to Owner, Architect, and others as requested.

END OF SECTION

SECTION 014000

QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Subcontractor's:
   1. Quality assurance and control of installation.
   2. Mockups.
   3. Manufacturer's field services and reports.

1.2 REFERENCES

A. ASTM C31-87 (Standard for making Concrete Test Specimens).
B. ASTM C39-86 (Test Method for Compressive Strength of Concrete Cylinders).
C. SC/DOT Standard Specifications for Construction
D. Timmons Group, Soils Report.
F. Virginia Building Code 2012 Edition
F. National Electrical Code 2011

1.3 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply fully with manufacturers' instructions, including each step in sequence,
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Contractor before proceeding.
D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Perform work by persons qualified to produce workmanship of specified quality.
F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 MOCKUPS

A. Assemble and erect specified items, with attachment and anchorage devices, flashings, seals, and finishes. Mock up to include at a minimum:
   All Finishes, Colors and Finish Transitions
   Door Opening with Trim
   Window Opening with Trim
   Roof Edge, Overhang, Fascia and Soffit
   Roofing Shingle Material
B. Erect at project site at location acceptable to Contractor.
C. Perform work in accordance with applicable specifications sections.
D. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been accepted by Contractor.
E. Contractor to provide initial rough in of each unit type for review by Owner and coordination of switch, receptacle, fixture, supply/exhaust grill and plumbing locations.

1.5 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, or startup of equipment, as applicable, and to
B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
C. Submit report to Contractor for review in duplicate within 30 days of observation.

1.6 SUBMITTALS

A. The Contractor is required to submit the following to the Engineer a minimum of 48 hours prior to commencement of the construction:

1. Asphaltic Concrete Mix designs for the bituminous base and wear courses.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
3.01 GENERAL SCOPE OF TESTING, INSPECTION

A. The Owner has retained the services of an independent Soils Engineer. The Contractor shall be responsible for coordinating all required tests and inspections with the Soils Engineer.

B. The following are minimum tests and inspections that shall be conducted for this project:

1. Site Grading:

a. The Soils Engineer shall provide necessary observations and tests, to evaluate whether the site grading improvements are completed in accordance with the requirements of the plans and specifications, including the requirements of FHA 79G.

b. The Engineer will observe the specified tolerance requirements.

2. Utility Construction:

a. The Soils Engineer will complete observations, and testing for the compaction required for the trench backfill in accordance with the requirements of the Soils Engineer.

b. The Engineer will observe the testing procedures as are outlined in the Utilities Specifications.

3. Aggregate Base Construction:

a. Random samples of the aggregate base shall be taken for gradation testing by the Owner's Soils Engineer. Unless directed otherwise by the Engineer, a minimum of 2 samples per 3,000 square yards of parking lot surface shall be obtained, or two samples per 1,000 linear feet of street.

b. Prior to placement of the aggregate base, the Engineer will require the completion of a test roll on the street subgrade. The test roll shall be completed in the presence of the Engineer. The Contractor shall provide a loaded tandem axle truck with a gross weight of 25 tons.

Test rolling shall be at the direction of the Soils Engineer and shall be completed in areas as directed by the Soils Engineer. The Soils Engineer shall determine which sections of the parking lot or street are unstable. Correction of the subgrade soils may be required.

Costs for the completion of test rolling shall be considered incidental to the street construction and no special payment will be made.

4. Asphaltic Concrete:

a. Random samples of the bituminous base and bituminous wear course materials shall be obtained for gradation and extraction testing by the Soils Engineer. A minimum of 3 samples per day of each course shall be obtained.

b. The Engineer will require the completion of density tests of the in-place Asphaltic Concrete material for each bituminous course placed. The testing shall be at the direction of the Soils Engineer and as specified in 02511, 3.02 of these Specifications.

5. Concrete Curb and Gutter and Sidewalk Construction

a. A set of three concrete test cylinders will be taken twice a day unless directed otherwise by the Engineer.

b. One additional test cylinder will be taken when there is a possibility that surrounding air temperatures will fall below 40 degrees F. This cylinder shall be cured on site under same conditions as the concrete it represents.

c. Curing of Specimens: ASTM C-31; one 7-day and one 28-day lab cured and the third for 56-day lab cured, if necessary.

d. Testing of Specimens: ASTM C-39.

e. One slump test should be taken for each set of test cylinders taken.

f. One air content test should be taken for each set of test cylinders taken.

END OF SECTION

SECTION 014100

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Selection and payment.
   2. Laboratory duties.
   3. Contractor's responsibilities.

B. Related Sections: Individual specifications sections contain specific tests and inspections to be performed.

1.2 REFERENCES

A. American Council of Independent Laboratories (ACIL): Recommended Requirements for Independent Laboratory Qualification.

B. American Society for Testing and Materials (ASTM) E 329: Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.3 QUALITY ASSURANCE

A. The Contractor will employ and will pay for services of an independent testing laboratory to perform specified testing and inspection. Contractor shall instruct all subcontractors to cooperate with the Testing Laboratory to facilitate performance of its work.

B. Refer to the Conditions of the Contract for provisions related to special inspections and testing.

C. Qualifications of Laboratory:
   1. Meet ACIL requirements referenced.
   2. Meet basic requirements of ASTM E 329.
   3. Authorized to operate in State in which project is located.

D. The Owner will pay for initial testing services requested by the Owner, except as noted in Mn/DOT Section 2360, Plant Mixed Asphalt Pavement.

1.4 LABORATORY DUTIES

A. Cooperate with Owner, Architect, and Sub Contractors; provide qualified personnel after due notice.

B. Perform specified inspections, sampling, and testing of materials and methods of construction:
   1. Comply with specified standards.
   2. Ascertain compliance or noncompliance of materials with requirements of Contract Documents.

C. Promptly notify Contractor, Owner, and Architect of any observed irregularities or deficiencies of Work or products.

D. Promptly submit written report of each test and inspection; one copy each to Owner, Lender's inspector, Architect, and two copies to Contractor. Report to be mailed directly to Owner and Architect by Laboratory. Each report shall include:
   1. Date issued.
   2. Project title and number.
   3. Testing Laboratory name, address, and telephone number.
   4. Name of Inspector and signature of individual in charge.
   5. Date and time of sampling or inspection.
   6. Record of temperature and weather conditions.
   7. Date of test.
   8. Identification of product and specification section.
   9. Location of sample or test in project.
   10. Type of inspection or test.
   11. Results of tests and compliance or noncompliance with Contract Documents.

12. Interpretation of test results when requested by Contractor or Architect.

E. Perform additional tests when required by Contractor or Architect.
F. Laboratory is not authorized to:
   1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Approve or accept any portion of work.
   3. Perform any duties of Contractor.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with Laboratory personnel and assure that all subcontractors cooperate to provide access to Work, and to manufacturer's operations.
B. When materials require testing prior to being incorporated into Work, secure and deliver to Laboratory adequate quantities of representative samples of materials proposed to be used.
C. Furnish copies of product test reports as required. Furnish incidental labor and facilities:
   1. To provide access to work to be tested.
   2. To obtain and handle samples at site or at source of product to be tested.
   3. To facilitate inspections and tests.
   4. For safe storage and curing of test samples.
D. Notify Subcontractor sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.

PART 2 PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 43 39

MOCK-UP REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements, including, but not limited to, repairs, corrective work, water testing and load testing at one (1) mock-up area as outlined in this Section.

1.2 DEFINITIONS

A. Water leakage, as defined in this Specification, is any water that appears on any normally exposed interior surfaces, or uncontrolled water that is not contained or positively drained back to the exterior, or water that can cause damage to adjacent materials, wall components or finishes. Water contained within drained flashings, gutters, and sills and is positively drained to the exterior is not considered water leakage.

1.3 SUBMITTALS

A. Provide three (3) copies of technical data, literature, and application instructions and samples as required by each Division's technical sections.

B. Provide technical data on sealant manufacturer's primer for silicones.

C. Contractor shall submit color charts for products to the Owner for color selection.

D. Submit record ("as built") sketches or markups on the "Remediation Details" after successful completion of water testing.

1.4 SITE MOCK-UP AREA

A. Scope of the water testing mock-up shall be a minimum of two (2) bays wide by one (1) floor high and include the interface area with adjacent windows or materials.

1. Construct a 10'-0" x 10'-0" minimum wall assembly containing each exterior material including, but not limited to, a window and a door with trim work, transitions, specified glazing, roofing conditions, framing, sheathing, insulation, waterproofing, sealants, and flashings. Color schemes are to be presented.

B. Location of mock-up to be determined at the pre-construction meeting.

1. Complete mock-up by date approved by Architect and Owner.

C. Notify Architect and Owner seven working days minimum in advance of dates and times when mock-up will be constructed and available for viewing and testing.

D. Contractor shall provide materials, equipment, and labor as required for the mock-up.

1. Use installers who will perform same tasks for Project.

2. Provide additional lighting where required to enable Architect to evaluate quality of the Work.

E. Work performed on the mock-up areas shall be in accordance with the Contract Documents. Changes or modifications made due to actual project conditions or as a result of water testing shall be fully documented. The approved test area shall be representative of work throughout the project and shall establish the standard by which the Work will be judged. Construct mock-up to verify selections made under sample submittals. Mock-up shall demonstrate the proposed range of aesthetic effects and workmanship, qualities of materials and execution, interface between dissimilar materials, compliance with installation tolerances, and operation.

F. In the event that interior water leakage occurs from an undetermined source, interior sheet rock or

ceiling removal may be necessary to isolate the water entry source. At conclusion of water testing, the Contractor shall return interior finishes to original condition.

G. Test area is subject to observations by the Owner and its consultants throughout the remedial work and testing. Provide material and personnel to meet the attached project schedule.

H. If failure occurs, rework and retest. Modifications shall be realistic and shall maintain standards of quality and durability and are subject to approval.

I. Obtain Architect's and Owner's approvals of mockup, including finishes, colors, and materials, before starting work, fabrication, or construction.

1. Allow ten working days for initial review and each re-review of each mockup.

J. Maintain mock-up in an undisturbed condition during construction as a standard for judging the completed Work.

1. Demolish and remove mockup when directed by Architect and Owner.

PART 2 - MATERIALS

A. Refer to MOCK-UP Article in PART 1 of this Section.

PART 3 - EXECUTION

3.1 PREPARATION OF THE WALL FOR WATER TEST

A. Perform work in accordance with the approved project specifications. No extra sealants or special installation methods not a part of the typical installation shall be used in this area.

3.2 MOCK-UP

A. Construct mock-up as specified in this Section and in accordance with approved shop drawings.

3.3 WATER TEST PROCEDURES

A. Hose Test In Accordance With AAMA 501.2.

1. The nozzle to be used shall be a B-25, No. 6.030 brass nozzle, with 1/2 inch FNPT, as manufactured by Monarch Manufacturing Works, 7249-B Browning Road, Pennsauken, NJ 08109. Telephone 800-394-7377 or 856-241-1500; Fax 856-324-0313.

2. The nozzle shall be used with a 3/4 inch garden hose and shall be provided with a control valve between the hose and the pressure gauge and a pressure gauge between the valve and the nozzle. The water flow to the nozzle shall be adjusted with the control valve to produce 30 to 35 psi water pressure at the nozzle gauge.

3. With the water directed at the joint and perpendicular to the face of the wall, the nozzle shall be moved at a rate of one foot per minute along the joint, at a distance of 12 inches. Observers including the Owner's consultant will inspect on the indoor side of the wall for any leakage and note where it occurs. Inspectors shall use a flashlight and magnifying glass or mirrors if necessary, to inspect for leaks.

4. If no leakage occurs during the test period, this length of joint shall be considered satisfactory. The next 5'-0" of joint shall be wetted for 5 minutes and testing continued until entire test area is covered.

5. If leakage has occurred at any point, the joint shall be taped at such points to prevent further leakage during the subsequent checking of joints adjacent to or above it.

6. The process outlined above shall then be repeated on joints and joint intersections within the designated area, always working upward on the wall.

B. Provide equipment and labor, including ladders, scaffolding, hoisting equipment, garden hoses, two way communication between exterior and interior, and flashlights, to conduct and observe the water test. Provide ladders to access the interior surfaces to observe for potential leakage and

scaffolding and hoisting equipment to access the exterior surfaces to perform water tests.

3.4 REMEDIAL WORK AND RE-CHECKING

A. Wherever leakage has occurred, joints shall be made watertight in a manner acceptable to the Owner.

B. Remedial work involving the use of curing-type compounds shall be allowed to set and cure for one week before it is re-checked for leakage.

C. After necessary remedial work has been completed and the required curing time, if any, has elapsed, check repaired joints again, following the same procedure as specified above in this Section.

D. Should leakage still be found, further remedial measures shall be taken and checking shall be repeated until joints in the designated area are found to be satisfactory.

END OF SECTION

SECTION 015000

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1- GENERAL

1.1 SUMMARY

A. Section includes:
   1. Temporary utilities.
   2. Field offices and sheds.
   3. Temporary controls.
   4. Protection of installed Work, security, and progress cleaning.
   5. Removal.

1.2 TEMPORARY ELECTRICITY

A. Service Required: Provide temporary electrical service of capacity and characteristics required for construction operations.
B. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.
C. Maintain distribution system and provide routine repairs.

1.3 TEMPORARY LIGHTING

A. Provide temporary lighting for construction operations and security purposes.
B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
C. Maintain lamps and provide routine repairs.

1.4 TEMPORARY HEAT

A. Provide temporary heating devices required to maintain specified ambient temperatures for construction operations.
B. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress (as required by manufacturers written instructions for materials, finishes and/or equipment being installed), unless otherwise indicated in individual Specification sections.

1.5 TEMPORARY VENTILATION

A. Ventilate enclosed areas to facilitate curing of materials, disperse humidity, and prevent accumulations of dust, fumes, vapors, or gases.

1.6 TEMPORARY TELEPHONE AND FACSIMILE SERVICES

A. Provide temporary telephone service required during construction.
B. Provide one alphabetical and one classified telephone service company directory for each instrument.
C. Provide facsimile machine in Contractor's field office.

1.7 TEMPORARY WATER

A. Provide temporary water required for construction operations.
B. Extend branch piping and provide temporary hoses so that water is available at locations needed for work.
C. Protect from freezing.
D. Maintain distribution system and provide routine repairs.

1.8 TEMPORARY SANITARY FACILITIES

A. Provide chemical toilets for use during construction. Comply with all local codes and ordinances.

B. Maintain facilities in clean and sanitary condition.

1.9 FIELD OFFICES AND SHEDS

A. Provide temporary field offices and storage sheds required for construction.

B. Do not unreasonably encumber site or premises with excess materials or equipment.

C. Temporary Structures:
   1. Portable or mobile buildings, structurally sound, weather tight, with floors raised above ground.
   2. Temperature transmission resistance: Compatible with occupancy and storage requirements.
   3. Provide connections for utility services when required.
   4. Provide steps and landings at entrances.

D. Field Office:
   1. Size required for Contractor's use and to provide space for project meetings.
   2. Adequate electrical power, lighting, heating, and cooling to maintain human comfort.
   3. Provide facilities for storage of Project Record Documents.

1.10 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas.

B. Provide barricades required by governing authorities for public right-of-ways.

C. Fencing:
   1. Provide temporary fencing for construction operations.
   2. Construction: Commercial grade chain link.
   3. Height: 6 feet.
   4. Locate to protect construction operations, materials, and equipment,
   5. Provide vehicular gates.

1.11 PROTECTION OF INSTALLED WORK

A. Protect installed work from construction operations; provide special protection when required in individual Specification sections.

B. Minimize traffic, storage, and construction activities on waterproofed and roofed surfaces. If traffic, storage, or activity is necessary, obtain recommendations for protection from waterproofing or roofing manufacturer.

C. Prohibit traffic from landscaped areas.

1.12 SECURITY

A. Provide a project security program, to:
   1. Protect the Work, stored products, and construction equipment from theft & vandalism.
   2. Prevent entry by unauthorized persons.

1.13 PROGRESS CLEANING

A. Maintain areas free from waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Provide containers for collection of waste materials, debris, and rubbish; remove and dispose of off site as required by construction activities.

C. Periodically clean interior areas to provide suitable conditions for finish work.

1.14 TEMPORARY CONTROLS

A. Water Control:
   1. Grade site to drain. Prevent puddling water.

2. Maintain excavations free of water.
3. Provide, operate, and maintain pumping equipment.
4. Provide water barriers to protect site from soil erosion.

B. Erosion and Sediment Control:
1. Plan and execute methods to control surface drainage from cuts, tills, borrow areas, and waste disposal areas. Prevent erosion and sedimentation.
2. Minimize amount of bare soil exposed at any one time.
3. Provide temporary measures such as dikes, berms, settlement basins, and drainage systems to prevent water flow and sedimentation.
4. Periodically inspect earthwork to detect erosion and sedimentation; promptly employ corrective measures.

C. Dust Control:
1. Provide dust control materials and methods to minimize dust from construction operations.
2. Prevent dust from dispersing into atmosphere.

1.15 REMOVAL

A. Remove temporary utilities, equipment, facilities, and services when construction needs can be met by use of permanent construction or upon completion of Project.
B. Remove foundations and underground installations, grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore permanent facilities used during construction to original or to specified condition.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 015800

PROJECT IDENTIFICATION AND SIGNS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:
   1. Project identification sign.
   2. Informational signs.
   3. Maintenance and removal.

1.2 QUALITY ASSURANCE

A. Project sign:
   1. Design sign and structure to withstand wind velocity required for location.
   2. Sign Painter: Experienced as a professional sign painter for minimum 3 years.
   3. Finishes, Painting: Adequate to withstand weathering, fading and chipping for duration of construction.

B. Fire lane signs.

C. Handicap sign.

D. Do not erect other signs at site without Owner's approval, except those required by governing authorities.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300:
   1. Shop Drawings: Show content, layout, lettering, colors, structure, sizes and Grades of members.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Structure and Framing: New lumber, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 23/32 inch thick, standard large sizes to minimize joints.

C. Rough Hardware: Galvanized steel or aluminum.

D. Paint and Primers: Exterior quality, two coats; sign background of color as selected.

E. Lettering: Exterior quality paint, contrasting colors as selected.

2.2 FABRICATION

A. Provide one painted project identification sign of following design:
   1. Area: 100 square feet or maximum permitted by law.
   2. Bottom edge of sign: 6 feet above ground.
   3. Content:
      a. Project Name
      b. Owner's name.
      c. Names and titles of Architect and Consultant's.
      d. Name of Contractor and major Subcontractors.
      e. Name of Lender.
      f. Name of Developer.

B. Provide informational signs:
   1. Painted signs with painted lettering or standard products.
      a. Size of signs and lettering: Required by regulatory agencies or as appropriate to usage.

b. Colors: Required by regulatory agencies, otherwise of uniform colors, throughout project.

2. Paint exposed surfaces: One coat of primer and two coats of exterior paint.

1. Paint graphics in styles, sizes, and colors selected.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Obtain temporary sign permits.

B. Project identification sign:

1. Install within 30 days after Notice to Proceed.

1. Erect at designated location.

2. Erect supports and framing on secure foundation, rigidly braced and frames to resist wind loadings.

3. Install sign surface plumb and level, with butt joints. Anchor securely.

4. Paint exposed

C. Informational signs:

1. Erect at appropriate location to provide required information.

2. Install at height for optimum visibility on ground mounted poles or attached to temporary structural surfaces.

3. Within two weeks of ground breaking.

3.2 MAINTENANCE

A. Maintain signs and support clean. Repair deterioration and damage.

B. Relocate informational signs as required by progress of Work.

3.3 REMOVAL

A. Remove signs, framing, supports and foundations at completion of Project and restore the area.

END OF SECTION

SECTION 016000

MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Related Documents: Provisions established in General and Supplementary Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

B. Section Includes:

1. Administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
2. Packaging, transportation, delivery, receiving, storage, protection and other product handling requirements.
3. Product options and substitutions including:
   a) Contractor's options in selection of products.
   b) Products list.
   c) Requests for substitution of products.

1.2 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 manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
2. "Materials" are products that are 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.

1.3 PRODUCT LIST

A. Prepare a schedule showing products specified in a 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.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

C. Coordinate the product list schedule with the Contractor's Construction Schedule.

D. Form: Prepare the product listing schedule with information on each item tabulated under the following column headings:

1. Related Specification Section number.
2. Generic name used in Contract Documents.
3. Proprietary name, model number and similar designations.
4. Manufacturer's name and address.
5. Supplier's name and address.
6. Installer's name and address.
7. Projected delivery date, or time span of delivery period.

E. Initial Submittal:
   1. Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list schedule.
   2. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
   3. 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.

F. Completed Schedule:
   1. Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list schedule.
   2. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

G. Architect's Action:
   1. Architect will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule.
   2. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents.
   3. The Architect's response will include the following:
      a) A list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.4 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
   1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that product products that possess these qualities, to the fullest extent possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between two 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 which will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is 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 which is inconspicuous in occupied spaces. 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.

D. Matching of Colors:
   1. When a product is listed in the specifications with an accompanying color, pattern, texture, or sheen, provide only that product, or one that is identical in color, pattern, texture, and sheen to the product specified, regardless if the color, pattern, texture, or sheen of the alternate manufacturer's product is a standard or option.
   2. On finished materials and products, verify that colors, patterns, textures, and sheens are identical for the entire project and that there are no visual differences between batches,

packages, bundles, or shipments, due to differing production runs. Architect reserves the right to reject products and materials installed, which have, in the sole opinion of the Architect, a significant enough difference in color, pattern, texture, or sheen, from other products on the project, so as to be visually distracting.

1.5 OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named within time frame specified herein.

C. Products Specified by Naming Several Manufacturers: Products of named manufacturers meeting specifications; no options, no substitutions.

D. Products Specified by Naming Only One Manufacturer: No option; no substitution allowed.

1.6 SUBSTITUTIONS

A. Limitations:

1. Requests for substitutions of products will be considered only within 30 days after date of **execution** of contract. Subsequent requests will be considered only in case of product unavailability or other conditions beyond control of Contractor.
2. Substitutions will not be considered:
   a) When indicated on shop drawings or product data submittal without separate formal request.
   b) When requested directly by subcontractor or supplier.
   c) When acceptance will require substantial revision of Contract Documents.
3. Do not order or install proposed substitute products without written acceptance.
4. Only one request for substitution for each product will be considered. When substitution is not accepted, provide specified product.
5. Architect will determine acceptability of substitutions.

B. Requests for Substitutions:

1. Submit separate request for each substitution. Document each request with complete data substantiating compliance of proposed substitution with requirements of Contract Documents. Utilize substitution request form attached.
2. Identify product by Specifications section and Article numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.
3. Attach product data as specified in Section 01330.
4. List similar projects using product, dates of installation, and names of Architect and Owner.
5. Give itemized comparison of proposed substitution with specified product, listing variations, and reference to Specifications section and Article numbers.
6. Give quality and performance comparison between proposed substitution and the specified product.
7. Give cost data comparing proposed substitution with specified product, and amount of net change to Contract Sum.
8. List availability of maintenance services and replacement materials.
9. State effect of substitution on construction schedule, and changes required in other work or products.

C. Contractor Representation:

1. Request for substitution constitutes a representation that Contractor has investigated proposed product and has determined that it is equal to or superior in all respects to specified product or that the cost reduction offered, if any, is ample justification for accepting the offered substitution.
2. Provide same warranty for substitution as for specified product.
3. Coordinate installation of accepted substitute, making such changes as may be required for Work to be complete in all respects.
4. Certifies that cost data presented is complete and includes related costs under this Contract.
5. Waives claims for additional costs related to substitution which may later become apparent.

6. Equivalent changes are those proposed because:
   a. A specified item is not readily available and the substitution provides equivalent or better utility and performance, or
   b. The proposed substitution reduces the contract price but provides equivalent or better utility and performance.

D. Submittal Procedures:
   1. Submit 3 copies of request for substitution.
   2. Architect will review Contractor's requests for substitutions with reasonable promptness.
   3. During the bidding period, Architect will record acceptable substitutions in Addenda.
   4. After award of Contract, Architect will notify Contractor, in writing, of decision to accept or reject requested substitution, generally within 14 days.
   5. For accepted products, submit shop drawings, product data, and samples under provisions of Section 01330.

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, unused at the time of installation.
   1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for 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: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
   1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
   2. Semi-Proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
      a) Where products or manufacturers are specified by name, comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
   3. Non-Proprietary Specifications: When the 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. General overall performance of a product is implied where the product is specified for a specific application.
      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 the 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 also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.

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.

PART 3 EXECUTION

3.1 PACKAGING AND TRANSPORTATION

A. Require supplier to package products in boxes or crates for protection during shipment, handling, and storage. Protect sensitive products against exposure to elements and moisture.

B. Protect sensitive equipment and finishes against impact, abrasion, and other damage.

3.2 DELIVERY, RECEIVING, AND HANDLING

A. Deliver, receive, and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft

B. Delivery:

1. Arrange deliveries of products in accordance with construction progress schedules. Allow time for inspection prior to installation.
2. Coordinate deliveries to avoid conflict with Work and conditions at site; work of other contractors or Owner; limitations on storage space; availability of personnel and handling equipment and Owner's use of premises.
3. Schedule delivery to minimize long-term storage at site and to prevent overcrowding of construction spaces.
4. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
5. Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
6. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.

C. Receiving and Handling:

1. Provide equipment and personnel to handle products, including those provided by Owner, by methods to prevent soiling and damage.
2. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.
3. Handle product by methods to avoid bending or overstressing. Lift large and heavy components only at designated lift points.
4. Immediately on delivery, inspect shipment to assure:
   a) Product complies with requirements of Contract Documents and reviewed submittal.
   b) Quantities are correct.
   c) Accessories and installation hardware are correct.
   d) Containers and packages are intact and labels legible.
   e) Products are protected and undamaged.

3.3 STORAGE

A. General:

1. Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.
2. Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

3. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

B. Enclosed Storage:
   1. Store products, subject to damage by the elements, in substantial weather tight enclosures.
   2. Maintain temperature and humidity within ranges stated in manufacturer's instructions.
   3. Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.
   4. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

C. Exterior Storage:
   1. Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.
   2. For products subject to discoloration or deterioration from exposure to the elements, cover with impervious sheet material. Provide ventilation to avoid condensation.
   3. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.
   4. Provide surface drainage to prevent erosion and ponding of water.
   5. Prevent mixing of refuse or chemically injurious materials or liquids.

D. Maintenance of Storage:
   1. Periodically inspect stored products on a scheduled basis.
   2. Verify that storage facilities comply with manufacturer's product storage requirements.
   3. Verify that manufacturer required environmental conditions are maintained continually.
   4. Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.

E. Maintenance of Equipment Storage:
   1. For mechanical and electrical equipment in long-term storage, provide manufacturer's service instructions to accompany each item, with notice of enclosed instructions shown on exterior of package.
   2. Service equipment on a regularly scheduled basis, maintaining a log of services; submit as a record document.

3.4 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.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

Attachment: Substitution Request Form

SUBSTITUTION REQUEST FORM

DATE: _____
Architect's Project No: _____

Project: _____

To: _____ From: _____

_____ _____

_____ _____

==========

Contractor (Bidder) hereby request acceptance of the following product or system as substitution in accordance with provisions of Section 01600 of the Specifications:

1. SPECIFIED PRODUCT OR SYSTEM:

   Substitution request for : _____

   Specification Section No : _____ Article: _____

2. SUPPORTING DATA:

   _____ Product data adequate for evaluation of the request for proposed substitution is attached (description of product, reference standard, performance and test data, specifications, drawings, photographs).

   _____ Sample is attached.

   _____ Sample will be sent if requested.

3. QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION
Name, Brand:	_____	_____
Catalog No.:	_____	_____
Manufacturer:	_____	_____
Vendor:	_____	_____
Significant Variations:	_____	_____

(Add Additional Sheets If Necessary)

Maintenance Service Available: Yes _____ No _____

Spare Parts Source: _____

Warranty Provided: Yes _____ No _____ Years _____
By Whom: _____

4. PREVIOUS INSTALLATIONS:
Identification of similar projects on which proposed substitution was used:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

5. REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS:

_____

_____

_____

6. EFFECT OF SUBSTITUTION:
Does the proposed substitution affect other work (adverse or otherwise):
No _____ Yes _____ (if yes, explain)

_____

_____

_____

_____

Substitution Changes Contract Time: No _____ Yes _____
Add/Deduct _____Days

Substitution requires dimensional revisions or redesign of the work: No _____ Yes _____ (if yes, attach explanation data)

Saving of credit to Owner: $ _____

Extra Cost to Owner: $ _____

7. CONTRACTOR'S (BIDDER'S) STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT DOCUMENTS:

I/we have investigated the proposed substitution. I/we:

- believe that it is equal or superior in all respects including function, appearance and quality to specified product, except as stated above;
- will provide same warranty and servicing requirements as specified for specified product;
- have included complete cost data and implications of the substitution;
- will pay for changes to the building design and special inspection costs caused by the use of this product;

- will coordinate the incorporation of the proposed substitution in the work;
- waive future claims for added cost to Contract caused by the substitution.

Contractor (Bidder): _____

Date: _____ By: _____
Answer all questions and complete all blanks - use "NA" if not applicable. Unresponsive or incomplete request will be rejected.

==========

ARCHITECT'S REVIEW AND ACTION

_____ Resubmit substitution request

_____ Provide more information in the following areas:

_____

_____

_____ Sign Contractor's (Bidder's) Statement of Conformance

_____ Substitution is accepted.

_____ Substitution is accepted, with the following comments:

_____

_____

_____ Substitution rejected.

_____ Substitution Request received too late.

_____ Date: _____
Architect

SECTION 017410

CONTRACTOR WARRANTY FORM

PROJECT:

LOCATION:

OWNER:

We, _____, Contractor, for the
(Company Name)
above referenced Project, do hereby warranty that all labor and materials furnished and work performed are in accord with the Contract Documents and authorized modifications, and will be free from defects due to defective materials or workmanship for a one year period from Date of Final Completion of the entire work. This Warranty commences on (Date of Final Completion)
and expires on (One Year from Date of Final Completion. Should any defect develop during the Warranty Period due to improper materials, workmanship or installation, the same shall, upon written notice by the Owner, **promptly** be made good by the undersigned at no expense to the Owner. Nothing in the above shall be deemed to apply to Work which has been abused or neglected by the Owner.

FOR: _____

BY: _____

TITLE: _____

DATE: _____

END OF SECTION

SECTION 017420

SUBCONRACTOR WARRANTY FORM

PROJECT:
LOCATION:
OWNER:
GENERAL CONTRACTOR:

We _____, Subcontractor for
(Company Name)

_____, as described in

Specification Section(s)_____, do
(List appropriate spec. sections)

hereby warrant that all labor and materials furnished and Work performed in conjunction with the above referenced Project are in accord with the Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials and workmanship for a period of _____ year(s) from (Date of Final Completion) and expires on (Expiration Date)

Should any defect develop during the warranty period due to improper materials, workmanship or installation, the same shall, upon written notice by the Owner, **promptly** be made good by the undersigned at no expense to the Owner. Nothing in the above shall be deemed to apply to Work which has been abused or neglected by the Owner.

FOR:

BY:

TITLE:

DATE:

SECTION 017430

ROOFING WARRANTY

PROJECT:

LOCATION:

OWNER:

ARCHITECT:

_____(Company Name) (hereinafter referred to as the Contractor) and _____(Company Name), (hereinafter referred to as the Roofing Subcontractor) jointly and severally warrant to the Owner that, all labor and materials are in accord with the Contract Documents, will be free of defects in materials and workmanship, and will remain in a watertight condition for a period of **Thirty Five (35) years for Residential Buildings and periods for Non Prorated Umbrella Coverage and Blow Off Warranty as indicated in specification section 07311,** beginning (Date of Final Completion), and expiring _____(Termination Date)_____.

WARRANTY CONDITIONING AND PROVISIONS

1. In executing this Warranty, Contractor and Roofing Subcontractor certify that they have inspected surfaces to receive roofing Work and have found surfaces satisfactory for roofing application and in accord with Contract Documents.

2. In event of defects in workmanship resulting in blistering, splitting, or similar defects, whether or not leaking results, Contractor and Roofing representative to determine whether defects exist. Repair defects encountered under the scope of this Warranty. Subcontractor shall make repairs to remedy defects within 30 days after notification by Owner, unless otherwise agreed upon in writing.

3. In event of leaks in the roof, Contractor and Roofing Subcontractor shall make repairs or modifications to the roof necessary to return roofing to a watertight condition. Initiate such repairs or modifications within 24 hours after notification by Owner, to be completed within 30 days unless otherwise agreed upon in writing.

4. Contractor and Roofing Subcontractor shall outline steps to be taken in writing, prior to making repairs or modification to defective roofing.

5. Owner shall give notices of defects to Contractor and Roofing Subcontractor by telefax or certified U.S. Mail within 30 days of suspicion of defects.

6. Owner shall allow Contractor and Roofing Subcontractor free access to roof as required for inspecting and testing of suspected defects and for performing repairs.

7. Number and extent of repairs shall be unlimited during warranty period.

8. In event of an emergency which requires prompt repair in order to avoid substantial damage to building and contents, Owner may make temporary repairs as may be essential and such action shall not be a breach of this Warranty.

9. In event that contractor's and Roofing Subcontractor's inspection reveals leaks or damages which are excluded under this Warranty, a maximum fee of $100.00 may be charges. This fee shall be in addition to the charge for repair of excluded work.

10. Roofing Subcontractor shall, prior to expiration of this Warranty, upon notification by Owner, re-inspect roof with Owner's designated representative to determine whether defects exist. Repair defects encountered under the scope of this Warranty.

EXCLUSIONS

Under Conditions of this Warranty, Contractor and Roofing Subcontractor shall not be responsible for the Following:

1. Damage caused by lightning, fire, earthquakes, sustained windstorms in excess of 120 miles per hour as recorded by nearest National Weather Service, or similar unusual natural phenomena; wars, riots, or civil commotion.

2. Structural defects in building which result in cracks greater than 1.16" in width in roof decks or misapplication of roof deck materials.

3. Damage to roofing caused by abrasion or abuse, including installation of fixed or moveable objects, without prior written approval of materials and methods by the Contractor and Roofing Subcontractor. Such approval shall not be unreasonably withheld.

4. Damage to roofing caused by actions of persons in the employ of the Owner, including, but not limited to, such tasks as cleaning roof drains, servicing equipment or cleaning windows.

5. Damage to roofing caused by the storing or discarding of materials on completed roof surfaces.

6. Repairs performed or repair materials furnished by other than the Contractor or Roofing Subcontractor.

7. **This warranty does not limit manufacturers' material warranties.**

Signed at _____this _____ day of _____ 19____.

By: _____ By: _____

Title:_____ Title: _____

For: _____ For: _____

(General Contractor) (Roofing Subcontractor)

Seal: Seal:

Accepted By:

Title:

For:

(Owner)

Attachments:
1) Roof Plan
2) Manufacturer's specification for roofing and flashing.
3) Copy of Manufacturer's material warranty.

END OF SECTION

SECTION 017500

CLEANING UP

1.00 GENERAL

1.01 GENERAL REQUIREMENTS:

A. General Contractor and subcontractors: Keep Project site free from accumulation of waste materials and rubbish at all times during construction period. Remove all waste materials and rubbish from and about Project, as well as tools, construction equipment, machinery, and surplus materials, except those specifically required by Contract Documents to be left for Owner's maintenance at completion of Work.

B. Upon failure to keep Project clean or to clean up prior to Date of Substantial Completion, Owner may do as provided in Paragraph 3.15 of the General Conditions; cost will be charged appropriately.

1.02 SAFETY REQUIREMENTS:

A. Store volatile and toxic waste in covered metal containers. Remove from Project site daily. Allow no volatile or toxic wastes to accumulate on Project site. Provide adequate ventilation during use of volatile or toxic substances.

B. Burning or burying of waste materials or rubbish on Project site is prohibited.

C. Disposal of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains, on pavements, in gutters or downspouts, or on Project site is prohibited.

D. Disposal of waste or cleaning materials which contain materials harmful to plant growth on Project site is prohibited. Clean up materials, which are accidentally spilled as quickly as possible.

1.3 CLEAN-UP DURING CONSTRUCTION:

A. Execute cleaning procedures to ensure that building, Project site, and adjacent properties are maintained free from debris and rubbish.

B. Wet down materials subject to blowing. Throwing of waste materials from heights is prohibited.

C. Provide covered, on-site containers for waste collection. Place all waste materials and rubbish in containers in an expeditious manner to prevent accumulation. Remove waste from Project site when containers become full.

D. Legally dispose of all waste materials, rubbish, volatile, materials, and cleaning materials off Project site.

E. Clean and maintain interior spaces prior to start of finish painting in a "broom clean" state until Date of Substantial Completion. Protect newly finished and clean surfaces from contaminated during cleaning operations.

F. Accumulation of debris contributing to survival or spread of rodents, roaches, or other pests is prohibited.
   1. Remove debris containing food scraps on a daily basis.
   2. Contractor shall be responsible for securing services of a pest exterminator at no additional cost to the Owner.

G. Disposal of materials in waterways in prohibited.

H. Graffiti or other similar distasteful comments or illustrations authored on any building materials used on Project is prohibited. Monitor Project for violations of this criteria, and, if found, take appropriate action immediately to cover or replace defaced materials as necessary.

1.4 FINAL CLEAN-UP:

A. Clean all finished surfaces in accord with manufacturer's product data and requirements specified in trade sections prior to Date of Substantial Completion. Perform all general and specific cleaning prior to request for Project or portion thereof to be inspected for Substantial Completion.

B. Remove dust, debris, oils, stains, fingerprints, and labels from exposed interior and exterior finish surfaces, including glass.

C. Replace, patch, and touch-up marred surfaces to match adjacent finishes. Replace materials which cannot be repaired or patched.

D. Clean disturbed areas of Project site of debris:

1. Power wash paved surfaces and all concrete blacktop and impervious surfaces. Remove oil and all substances.
2. Remove debris from grassed and landscaped areas and disturbed areas.

E. Install new clean sets of HVAC system filters at Date of Substantial Completion; clean ducts, blowers, and coils of HVAC equipment to full y remove construction type dust and debris from system components.

F. Wash and clean all vertical building surfaces after substantial completion of the final building acceptance.

G. Clean all walkways, roadways, trash, from landscape areas, etc.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Project Record Documents.
   3. Operation and maintenance manuals.
   4. Emergency Manuals
   5. Warranties.
   6. Instruction of Owner's personnel (Demonstration and Training).
   7. Final cleaning.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: The following items shall be completed prior to requesting inspection for determining date of Substantial Completion:
   1. Prepare a list of items to be completed and corrected (punch list). Include the value of items on the list.
      a. Preparation: Submit 3 copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including areas disturbed by Contractor.
      b. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
      c. Organize items applying to each space by major element.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   9. Submit test/adjust/balance records.
   10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   11. Advise Owner of changeover in heat and other utilities.
   12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
   13. Complete final cleaning requirements, including touchup painting.
   14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Prior to requesting final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment in accordance with Section 01 29 00 - Payment Procedures.
   2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report and warranty.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 PROJECT RECORD DOCUMENTS

A. General: Contractor shall maintain a complete and accurate record of changes or deviations from the Contract Documents and Shop Drawings, indicating the Work as actually installed. Record information in the appropriate locations on a record set of prints of the Drawings and Shop Drawings and a copy of the Specifications that are maintained solely for the purpose of this documentation. Keep this record set of Contract Documents and Shop Drawings at the project site for review by the Owner and Architect.
   1. Do not use Project Record Documents for construction purposes.
   2. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
   3. The Individual or entity who obtains record data shall prepare Record Documents.
   4. Information contained in the record documents shall include, but not be limited to:
      a. Actual installation where actual installation varies from original drawings
      b. Modifications made by Addenda, Change Orders, Construction Change Directives and Architect's Supplemental Instructions which shall be transferred to the record documents.
      c. Location of underground pipes, conduits, ducts, cables and similar work, dimensioned horizontally to permanent points of reference and located vertically by indicating depth of burial. Dimensions shall be accurate within $\pm$6 inches.
      d. Location of plumbing piping, sprinkler piping, control valves, heating and air conditioning equipment, mechanical piping, ductwork, major conduit runs, power, control and alarm wiring, etc., dimensioned horizontally to permanent points of reference. Dimensions shall be accurate within 6 inches.
      e. Modifications made to accommodate field conditions.

f. Location and function of mechanical and electrical control devices and shut-off valves.
g. Final circuiting of electrical fixtures and equipment.
1) Record and check the markup before enclosing concealed installations.
h. Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

B. Final Record Drawings:
1. Record Prints: Maintain one full set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
2. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings and Shop Drawings.
3. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
4. Refer instances of uncertainty to Architect for resolution.
5. Architect will make the Contract Drawings available to Contractor to be printed at Contractor's expense.

C. Number of Copies:
1. Initial Submittal: Submit one set of corrected Contract Drawings and one set of marked-up Record Prints.
2. Initial Submittal: Submit one digital set of corrected Record Drawings and one digital set of marked-up Record Prints.
3. Final Submittal:
a. Marked-up Record Prints: One set.
b. Record Prints: One set.
c. Copies printed from Record Prints: 3 copies. Print each Drawing, whether or not changes and additional information were recorded.

D. Format:
1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Digital Data Files:
a. Format: Same digital data software program, version, and operating system as the original Contract Drawings.

E. Identification: Provide the following information on each Drawing:
1. Project name.
2. Date.
3. Designation "PROJECT RECORD DRAWINGS."
4. Name of Architect.
5. Name of Contractor.

F. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Where installation varies from that indicated, mark copy to indicate the actual product installation.
1. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
2. Note related Change Orders and Record Drawings.

G. Miscellaneous Record Submittals: Bind or file miscellaneous records with identification labels clearly visible.

1.5 OPERATION AND MAINTENANCE MANUALS

A. General: Assemble 3 copies of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
   1. Operation Data: Include complete operating sequence, control diagrams, description of method of operating machinery, machine serial numbers, factory order numbers, parts, tests, instruction books, suppliers phone numbers and addresses, individual equipment guarantees, parts and part numbers.
   2. Maintenance Data: Include manufacturer's information, a list of spare parts, maintenance procedures, maintenance and service schedules for preventive and routine maintenance, and copies of warranties and bonds. Include lists of filter sizes for air handling equipment, indicating which unit filter if for and if filter is “washable" or "disposable".

B. Organization:
   1. Organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system.
   2. Include a title page and table of contents in each manual.

C. Format:
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

D. Provide manufacturer’s operations and maintenance videotapes of each specific equipment item or system.

E. Upon substantial completion of the Project Work, submit one copy of the Maintenance Manual and Operating Instructions to the Architect for approval. Upon receipt of Notice of Approval, deliver the additional copies to the Owner.

1.6 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for type of emergency, emergency instructions, and emergency procedures. Include instructions and procedures for each system, subsystem, piece of equipment, and component.

B. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

C. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

1.7 WARRANTIES

A. Submittal Time: Submit written warranties upon request of Architect for designated portions of the Work where commencement of warranties. Warranties will begin at substantial completion of entire project. There will be no interim dates. All warranties to have same one year period.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
   4. Warranty Digital File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Include an additional copy of each warranty in the operation and maintenance manuals.

1.8 OWNER’S MANUAL

A. Prior to final payment, submit one hard-back, loose-leaf binder containing the following items, typed, indexed and labeled for ready reference:
   1. Subcontractors, major suppliers list with company’s names, addresses and telephone numbers.
   2. Certifications.
   3. Affidavit from general and subcontractors on use of asbestos free materials.
   4. List of Extra Materials supplied to Owner, signed by Owner's representative.
   5. Other items required by the Specifications.
   6.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment.
   1. Provide instructors experienced in operation and maintenance procedures.
   2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
   3. Schedule training with Owner, through Architect. Provide a minimum of 7 days' advance notice.
   4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
   5. Include video of actual demonstration as part of turnover.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment type, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline.
   1. Include instruction for system design and operational philosophy, review of documentation, operations, adjustments, troubleshooting, maintenance, and repair.

3.2 FINAL CLEANING

A. General: Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      g. Sweep concrete floors broom-clean in unoccupied spaces.
      h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
      i. Clean transparent materials, including mirrors and glass in doors and windows, taking care not to scratch surfaces. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
      j. Remove labels that are not permanent.
      k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

m. Replace parts subject to unusual operating conditions.

n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

q. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

E. Make building(s) ready for occupancy in every respect. Lay heavy building paper in main circulation areas to protect the floors until final inspection and acceptance.

F. Existing improvements, inside or outside the property which are disturbed, damaged or destroyed by the Work under the Contract shall be restored to the condition in which they originally were, or to the satisfaction of the Architect.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 032000 - Concrete Reinforcement.

B. Section 033000 - Cast-in-Place Concrete.

1.2 REFERENCES

A. ACI 347 - Recommended Practice For Concrete Formwork.

1.3 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Submit manufacturers technical data and written installation instructions, minimum 30 days prior to start of scheduled installation.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Secure Inc. Form release agent.

B. Substitutions or Owner approved equal: Under provisions of Section 01600.

2.2 MATERIALS

A. Form Materials: At discretion of Contractor.

B. Form Ties: Snap-off type, galvanized metal., adjustable length cone type, with waterproofing washer, 1 inch back-break dimension, and free of defects.

C. Form Release Agent: Strip Form Release, clear non-viscous, non-toxic liquid which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, and levels before proceeding with formwork. Ensure dimensions agree with Drawings.

B. Beginning installation means acceptance of existing conditions.

3.4 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.5 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. During cold weather; remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms.

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SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 03 10 00 - Concrete Formwork.

B. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements For Reinforced Concrete.

C. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.

D. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

E. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

F. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI Manual of Practice.

1.4 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain finish.

B. Stirrup Steel: ANSI/ASTM A82, plain finish.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge annealed type.

B. Chairs, Holsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

2.3 FABRICATION

A. Fabricate reinforcing in accordance with CRSI Manual of Practice.

PART 3 EXECUTION

3.1 INSTALLATION

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

1. Bend bars cold; do not heat reinforcing or bend by make-shift methods. Discard bent, kinked or otherwise damaged bars.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART GENERAL

1.1 SECTION INCLUDES

A. The work of this Section consists of all plain and reinforced concrete work as shown on the Drawings and as specified herein, and includes, but is not limited to the following:

1. Furnishing, placing, curing and finishing of all plain and reinforce concrete work for the building and site.
2. Furnishing, erection and removal of formwork and shoring.
3. Furnishing and placing of reinforcing steel and related accessories.
4. Furnishing and installation of bentonite strip waterstops.
5. Furnishing and installation of joint fillers.
6. Setting of anchor bolts and grouting of leveling plates and bearing plates.
7. Coordination with all other trades for location of all pipe sleeves, roof drains, floor drains, duct openings, keys, chases, electrical boxes and conduits, anchors, inserts, fastenings and other devices required by other trades.
8. Hardening and sealing of exposed concrete floors.
9. As-built surveys of concrete floor slab elevations.
10. Leveling of concrete slabs.

B. Items to be installed only: Install the following items furnished by the designated Sections:

1. Division 05 – Metals: Anchor bolts, embedded plates with bolts or anchors, as indicated on the Drawings.

1.2 REFERENCES (LATEST EDITIONS)

A. ASTM listed standards by the American Society for Testing and Materials.

B. ACI listed standards by the American Concrete Institute.

C. CRSI listed standards by the Concrete Reinforcing Steel Institute.

D. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.

E. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an

affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.3 SUBMITTALS

A. Submit complete Shop Drawings, Samples and other Data in accordance with the provisions of Section 01 33 00 - Submittals.

1. Shop Drawings:

a. Construction joint layout: Submit drawings showing proposed construction joint locations for all walls, slabs, slabs on metal deck, beams, etc. Drawings shall be submitted prior to preparation of reinforcement drawings.

b. Reinforcement Drawings: Prepare in accordance with ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structure" and show following: elevations; dimensions of concrete work with specified reinforcement clearances; ledges, brackets, openings, sleeves or other items furnished by other Sections, where interference with reinforcement may occur; bending diagrams; assembly diagrams; splices and laps of reinforcement; temperature and shrinkage reinforcement; construction joint locations and reinforcement; shapes, dimensions, grade designations and details of reinforcement and accessories. Show dowels with concrete work to be placed first. Indicate suitable marks for placing bars.

c. Formwork Drawings: Schedules of placement; beam and haunch detailing, expansion joint details, construction joints and contraction or control joints with methods of forming; general arrangement, sizes and grades of lumber, panel and tie layouts and alignment. Formwork drawings will be reviewed for general compliance with Contract Documents only. Dimensions, strength of formwork, shoring, bracing, etc. are the sole responsibility of the Contractor.

d. Except as otherwise noted, approval of Shop Drawings will be for size and arrangement of components. Errors in dimensions shown on Shop Drawings shall be responsibility of Contractor.

e. Check and coordinate cast-in-place concrete work with work of other trades before submitting Shop Drawings.

f. Submit plans for all levels with M.E.P. penetration sizes and locations for approval prior to submitting reinforcing shop drawings.

g. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for us as Shop and Coordination Drawings is subject to the following conditions:

(1) The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from United Structural Consultants, Inc. without any warranties, guarantees

and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.

(2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.

(3) The User further agrees to release, indemnify, hold harmless and defend United Structural Consultants, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

2. Concrete Constituents: Submit a detailed list of concrete materials and corresponding sources, proposed for use in concrete for this project. If conveying concrete by pump is requested by Contractor, related data regarding concrete materials, pumping devices and methods shall be submitted to Architect for approval three weeks before such method is proposed for use. Provide concrete mix data as specified in Paragraph 2.2B.

3. Methods of Construction: Prior to starting work, submit summary of methods, sequence of construction, and type of equipment proposed for use for performing cast-in-place concrete work. This submission shall not relieve Contractor of his responsibility for providing proper methods, equipment, workmanship and safety precautions.

4. Samples: Submit samples and/or descriptive literature of materials, products, and methods as noted herein, and as otherwise requested by the Architect: concrete constituents including admixtures; form ties and spreaders; accessories for reinforcement; reglets; non-shrink cement grout; inserts; form release agents and waterstops.

5. Mill Test Certification: Prior to delivery of steel or concrete to job site, submit certified mill test reports of reinforcing steel and cement, (including names and locations of mills and shops and analyses of chemical and physical properties) properly correlated to concrete to be used in this project. Test reports for reinforcing to be welded shall show that the steel meets AWS weld ability requirements.

6. Shoring and Reshoring: submit for general review, calculations and plan layouts for all shoring and reshoring. Reshoring calculations shall address deflection of concrete slabs and beams, utilizing the Modulus of Elasticity (as determined by laboratory testing) for the age of concrete at the time of reshoring. The design, installation and removal of shoring is the sole responsibility of the Contractor.

7. Concrete Curing and Protection: Submit summary of methods proposed for curing and protection of concrete.

8. Corrective Work: Submit drawings showing details of any proposed corrective work.

9. Affidavit: Submit, upon request by Architect, manufacturer's and/or supplier's and/or installer's affidavit stating that material or product provided complies with Contract Documents.

B. Provide concrete Mix Data as specified in Paragraph 2.2B.

C. Provide manufacturer's data for other products.

D. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Contractor.

E. The Contractor is responsible for furnishing and installing materials called for in Contract Documents, even though these materials may have been omitted from approved Submittals.

1.5 QUALITY ASSURANCE

A. All materials, measuring, mixing, transportation, placing and curing shall be subject to inspection by the Architect or by the testing agency. However, such inspection, wherever conducted, shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of material or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.

B. A qualified testing agency for testing and inspection will be selected by the Owner.

C. The Contractor shall retain the services of a qualified testing agency, approved by the Architect, to test aggregate and to prepare or review mix designs for each strength of concrete specified, and shall submit mix designs and test results to the Architect for approval. The costs of all such services shall be borne by the Contractor.

D. Advise the testing agency of intent to place concrete by notification at least 24 hours prior to the time of placement.

E. Concrete will be sampled and tested for quality control as follows:

1. ASTM C 172: Sampling fresh concrete.
2. ASTM C 31: Compression test specimens.
3. ASTM C 143: Slump
4. ASTM C 231: Air content
5. ASTM C 39: Compressive strength.
6. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Uses as a Mineral Admixture in Portland Cement Concrete.
7. ASTM C 311: Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

F. All reinforcing shall be inspected by the testing agency for grade, size, spacing, position, cleanliness, cover and support.

G. Cooperate with the testing agency's work and provide help as required for taking and storing samples. Provide storage facilities for concrete cylinders at the site. Facilities must protect cylinders from affects of low or high temperatures in cold or hot weather, respectively.

H. Compression tests shall consist of six (6) cylinders for each test made, cured and tested by the laboratory during the progress of the job. At least one (1) test shall be made for each strength of concrete up to 50 cubic yards pour, and at least one (1) test per strength for each 50 cubic yards thereafter, unless otherwise directed by the Architect. Concrete for each set of cylinders shall be from one (1) sample representative of the entire batch. All cylinders shall be standard 6" X 12".

I. In addition to the above, the Architect or the Contractor may direct additional control cylinders to be made, cured and tested to verify strengths for removal of forms, shoring or adequacy for curing or cold weather protection. In such instances, the cylinders shall be cured in the same environment as the area which the cylinders represent. All such additional work requested by the Contractor shall be at his own expense.

J. Evaluation of Compression Tests:

1. Architect has authority to order, for any strength of concrete, increase in cement content and mix redesign for remaining work of either:

a. Average 7-day strength of any two consecutive tests representing a particular design strength of a class of concrete is less than 55 percent of specified strength; OR

b. Average 28-day strength of any two consecutive tests representing particular design strength of a class of concrete is less than 90 percent of specified strength.

2. The strength level of a class of concrete shall be considered satisfactory, if the following requirements are met:

a. Averages of any three consecutive 28-day strength tests representing each class of concrete equal or exceed the specified strength (f'c).

b. Not more than 10 percent of 28-day strength tests have values less than the specified strength (f'c).

c. No individual 28-day test shows an average strength less than 90 percent of specified strength (f'c).

3. When tests of control specimens fall below the strength level requirements, the Architect may require core specimens taken from concrete in question and tested in accordance with ASTM C 42. If these specimens do not meet the strength requirements, the Architect will have the right to require additional curing, load tests, strengthening or removal and replacement of those parts of the structure which are unacceptable, and in addition, removal of such sound portions of structure as necessary to insure safety, appearance and durability of the structure.

Additional testing, load tests, strengthening or removal and replacement of parts of the structure and any costs associated with redesign or delay of the project shall be at the Contractor's expense.

K. Upon completion of concrete testing for the project the testing agency shall compile all results and perform a statistical strength analysis for each class of concrete in accordance with ACI 214.

L. Accept as final, results of tests made by the qualified professional testing organization engaged by the Owner.

M. Testing required because of changes requested by the Contractor in materials, sources of materials or mix proportions, and extra testing of concrete or materials because of failure to meet the Specification requirements is to be paid by the Contractor.

N. A final report shall be issued by the testing agency following the completion of work in this Section stating that all deficiencies have been corrected.

1.6 NOTIFICATION OF RELATED TRADES

A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, louvers, etc. when ready for such installation, and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.

B. Leave openings in walls for pipes, ducts, etc. for mechanical and electrical work, as shown on Drawings or required by layout of mechanical systems.

PART 2- PRODUCTS

2.1 MATERIALS

A. Cement
- **1.** Portland Cement - ASTM C 150, Type I or II.
- **2.** Fly Ash – ASTM C 618 Class F.

B. Natural Aggregate
- **1.** Coarse aggregate: Shall be hard, durable, uncoated crushed stone or washed gravel conforming to ASTM C 33 and the following additional requirements.
  Nominal Size: 3/4" (Use 3/8" aggregate at topping slabs 3 inches or less in thickness or at areas of closely spaced reinforcing.)
  Fineness Modulus: (+/- 0.20) 6.70 and 5.5 respectively
  Organic: Plate 1 maximum.
  Silt: 1.0 % maximum
  Soundness: 5% - 8% maximum loss, magnesium sulfate, five cycles.

2. Fine Aggregate: Shall be sand, clean, hard, durable, uncoated grains, free from silt, loam and clay, to meet ASTM C 33 and the following additional requirements:

Sieve	Retained Percent
#4	0-5
#16	25-40
#50	70-87
#100	93-97

Fineness Modulus: 2.8 (+/- 0.20)
Organic: Plate 2 maximum
Silt: 2.0% maximum
Soundness: 5% - 10% maximum loss, magnesium sulfate, five cycles.

C. Water
1. Water shall be from the local municipal supply.

D. Admixtures
1. Water-reducing Agent shall conform to ASTM C 494, Type A. Water-reducing agent shall be compatible with air-entraining agent.
2. Superplasticizer shall conform to ASTM C494, Type F or Type G. Superplastizer shall be compatable with the other admixtures.
3. Air-entraining agent shall conform to ASTM C 260.
4 Calcium Chloride or admixtures containing more than 0.1% Chloride ions are not permitted.

E. Concrete Reinforcement
1. Reinforcing steel shall conform to ASTM A 615 deformed bars, Grade 60.
2. Welded wire fabric shall conform to ASTM A 185 in flat sheets.
3. Bar supports, metal accessories and other devices necessary for proper assembly of concrete reinforcing shall be of standardized factory-made wire bar supports. Wire for tying shall be ASTM A 82, 18 gauge black annealed wire. All accessories shall conform to Product Standard PS7-766, National Bureau of Standards, Department of Commerce, Class C.
4. Accessories touching formed surfaces exposed to view shall have not less than 1/4 inch of high density polyethylene between metal and concrete surface. Plastic tips shall extend not less than 1/2 inch up on metal legs.

F. Formwork
1. Forms for concrete surfaces not exposed to view, shall be made of wood, metal, or other material subject to approval of Architect.
2. Form release agent shall be of a non-staining type, specifically manufactured for concrete forms.

3. Forms for smooth surfaces exposed to view or to receive a skin coat of plaster and/or paint shall be smooth and subject to approval of the architect by way of a mockup test panel.

4. Form ties shall be factory-fabricated, removable or snap back of approved design. Wire shall be at least 1-1/2" back from exterior surfaces and 1" from interior surfaces.

5. Chamfer strips shall be one-half inch, 45 degree wood strips, or as detailed, nailed six inches on center, and installed at inside corners of all forms, unless otherwise directed by the Architect.

6. Reglets shall be formed from 24 gauge galvanized steel and shall be of type shown on Drawings or appropriate for use intended. Metal reglets shall be used merely as form to obtain desired profile. After concrete has set, remove reglets.

G. Bonding agent for bonding new concrete to existing concrete at construction joints shall be Sikadur 32, Hi-Mod by Sika Corporation or equal approved by the Architect.

H. Self Leveling Concrete Underlayment

1. Concrete underlayment used for floor leveling shall be SikaSet by Sika Corporation, Ardex K-15 by Ardex, Inc., Bonsal Self Leveling Wear Topping by W. R. Bonsal Company or equal approved by Architect. For feather finish areas use Ardex SD-F or equal approved by the Architect.

2. Aggregate shall be well-graded, washed fine gravel (1/8 inch to 1/4 inch or larger) for use when underlayment is installed over 1/2 inch thick.

3. Gypsum based underlayment products are not allowed.

I. Surface Conditioners

1. Floor Hardener for exposed concrete floors shall be “Liqui-Hard” by W.R. Meadows, Inc. or equal approved by the Architect.

J. Other Materials:

1. Joint filler where used with caulking or sealants, shall be cork type, non-extruding, self-expanding filler strips conforming to ASTM D 1752, III. Where no sealant or caulking is required, strips shall be closed cell flexible polyethylene type conforming to ASTM D 1752. Joint fillers for exterior paving shall be non-extruding bituminous type in accordance with ASTM D 1751.

2. Flexible epoxy joint sealant shall be Sikadur 51 NS/SL by Sika Corporation, or approved equal.

3. Threaded Inserts: Richmond Screw Anchor Co. or equal structural concrete inserts of type shown on Drawings. Galvanize all components in accordance with ASTM A 153.

4. Waterproof Kraft Paper shall be in accordance with ASTM C 171.

5. Waterstops shall be bentonite strip type Waterstop – RX, manufactured by Cetco or equal as approved by the Architect.

6. Non-Shrink Grout: Shall be "SetGrout" by Master Builders, "Sono Grout" by Sonneborn Contech, Inc. "Five Star Grout" by U.S. Grout Corporation or equal approved by the Architect.

7. Dovetail Anchor Slots shall be formed of not less than 20 gauge hot dipped galvanized steel, 1" by 1" and furnished with felt or fiber fillers.

2.2 CONCRETE MIXES

A. Strength, cement and water requirements:

Design Compr. Strength, f'c	Min. Cement Factor*	Max. Water Cement Ratio	Sacks/yd3 lbs/yd3	Gal/sack Gal by wt.
*2500	470	0.62	7.0	5.0
3000	517	0.57	6.5	5.5

*Fly Ash may be used in all concrete except exterior walks and retaining walls. Amount may be up to approximately 20% of the total cement content.

*Lightweight Concrete shall be designed for 2500 psi as specified above in table. Max. slump shall be 5", (+/- 1"). Dry density weight of lightweight concrete shall be 110-120 PCF.

B. All concrete shall be proportioned in accordance with ACI Standard 211.1, "Recommended Practice for Selecting Proportion for Normal and Heavyweight Concrete" and comply with the requirements of ACI 301 "Specifications for Structural Concrete" Chapter 3, Method 1 (trial batches) or 2 (field experience).

C. Air-entraining and water-reducing agents shall be used in all concrete, in strict accordance with the manufacturer's printed instructions. Total air entrained in freshly mixed interior concrete shall be 4.0% plus or minus 1.0% of volume of concrete with required strengths maintained, except that all interior slabs subject to abrasion shall have a maximum air content of 3% and all exterior concrete subjected to freezing and thawing shall have an air content of 5% plus or minus 1%.

D. Water-Cement Ratio - All concrete subjected to freezing and thawing shall have a maximum water-cement ratio of 0.49 (f'c = 4000 psi minimum). All concrete required to be watertight and/or subjected to de-icers shall have a maximum water-cement ratio of 0.45 (f'c = 4500 psi minimum). This is a total water in mix at time of placement, including free water of aggregates and liquid admixtures.

E. Slump of concrete shall be 4" (+/-1"). If a superplasticizer is used, the slump shall be 3" (+/-1") prior to adding the superplasticizer and 8" (+/-1") after adding the superplasticizer.

F. Premix admixtures in solution form and dispense as recommended by the manufacturer. Include the water in the solution in the design water content of the mixtures.

PART 3 EXECUTION

3.1 STORAGE

A. All materials shall be stored to prevent damage from the elements and other causes.

B. Cement and aggregates shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Any materials which have deteriorated, or which have been damaged, shall not be used for concrete.

C. Store reinforcing steel on wood skids to protect it from earth and damage from trucking or other construction operations. Reinforcement shall be free from loose mill scale, rust, release agent, concrete splatter and other extraneous coatings at the time it is embedded in the concrete.

D. All forms shall be stored in neat manner and orderly fashion, protected from the weather and abuse.

E. Materials which are judged not acceptable for this project shall not be stored on the site, but shall be immediately removed from the site.

3.2 FORMING

A. Formwork construction shall be as specified in ACI 347 "Guide to Formwork for Concrete".

B. Acceptable tolerances shall be as specified in ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials”. Concrete formed surfaces not exposed to view shall conform to Class C requirements.

C. Forms shall be constructed to conform to shapes, lines, and dimensions shown, plumb and straight, and shall be maintained sufficiently rigid to prevent deformation under load. Forms shall be sufficiently tight to prevent the leakage of grout. Securely brace and shore forms to prevent displacement and to safely support the construction loads.

D. Treat forms with a form release agent applied according to the manufacturer's instructions, by roller, brush or spray to produce a uniform thin film without bubbles or streaks. Apply the release agent in two coats for the first use of the form and in one coat for each additional use.

3.3 MIXING PROCESS

A. Ready-mixed concrete shall be mixed and transported in accordance with "Specification for Ready-Mixed Concrete" ASTM C 94, Alt. #3 and ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".

3.4 REINFORCING

A. Reinforcing shall be securely tied and supported to maintain proper spacing and cover during placing operations. Take particular care to bend tie wire ends away from exposed faces of beams, slabs, and columns. In no case shall ends of tie wires project towards or touch formwork. All reinforcing and accessories shall be placed in accordance with CRSI Standards 63 and 68. Reinforcing shall be free of excessive rust, scale or other coatings that will reduce bond.

3.5 EMBEDDED ITEMS

A. Coordinate the installation of all embedded items required by other trades. Such items normally are to be in place prior to the placing of reinforcing steel.

B. Place all anchor bolts, sleeves, inserts, etc. and secure properly.

C. Conduits and Pipes by M.E.P. Contractors: Embed no pipes other than electrical conduit in structural concrete. Provide steel pipe sleeves for pipes passing through. Embed conduit in concrete only under the following conditions:

1. No conduit coating, except galvanizing or equivalent shall be used. Do not embed aluminum conduit in concrete.
2. Do not cut or displace any reinforcement.
3. Place conduit within the middle half of any member. Do not place conduit between concrete surfaces and reinforcement.
4. Slabs- Restrict O.D. of conduit to less than 1/4 of slab thickness. Place within middle of slab thickness.
5. Place conduit larger than 1/6 slab thickness parallel and at right angles to slab reinforcing, not diagonally.
6. Place nearly parallel conduits apart at least 3 times O.D.
7. Do not embed conduit over 4 percent of the gross concrete area lengthwise in beams or columns.
8. Do not place conduit in concrete toppings on metal deck.

3.6 JOINTS

Provide construction joints as shown on the Drawings, but in any case limit the maximum dimensions for placement of concrete in any one placement as follows:

1.	Walls:	80 feet
2.	Reinforced slabs, beams:	100 feet
3.	Slabs-on-grade:	100 feet

4. Slabs on Metal Deck: 100 feet

B. Construction joints shall be formed with keyed bulkheads. Reinforcement shall continue through the joint, and additional reinforcement shall be placed as indicated on the Drawings.

C. Provide control joints as shown on the Drawings, but in any case limit the maximum dimensions between joints as follows:

1. Slabs-on-grade: 25 feet

D. Control joints shall be saw cut, as early as practical, the day after placement and finishing of concrete. Discontinue 50% of the reinforcement at the joint. Do not place control joints in slabs on metal deck.

3.7 PLACING

A. Notify the Architect and Structural Engineer at least 72 hours prior to each placement.

B. Do not place concrete until soil bearing material, reinforcing steel, inserts, sleeves and other work to be built into the concrete have been inspected and approved by the Architect and all trades concerned.

C. In hot weather, all concreting shall be done in accordance with ACI 305, "Recommended Practice for Hot Weather Concreting".

1. When temperature rises above 70 degrees F, all surfaces of concrete shall be protected against rapid drying.
2. Concrete delivered to the forms shall have a temperature of not over 90 degrees F.
3. The temperature of the forms shall not be over 90 degrees F.

D. In cold weather, all concreting shall be done in accordance with ACI 306, "Recommended Practice for Cold Weather Concreting".

1. When the average daily temperature falls below 40 degrees F, all surfaces of concrete shall be maintained at a temperature of at least 50 degrees F and not over 90 degrees F for seven (7) days.
2. Concrete delivered to the forms shall have a temperature of at least 60 degrees F and not over 90 degrees F.
3. The temperature of the forms including gravel base, shall be at least 40 degrees F.
4. The Contractor shall maintain a record of temperature of the concrete at the most exposed surfaces of each placement at the beginning and at the end of each day of the curing period, which shall be available to the Architect.

E. Conveying - Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is retained.

F. Depositing - Delivery and placement of concrete shall be programmed so that the time lapse between batching and placement shall not exceed 1-1/2 hours. Concrete shall not be allowed a free fall of over 4 feet. Concrete shall be deposited as nearly as practicable in its final position, to avoid segregation due to rehandling or flowing.

G. Concrete shall be deposited continuously, in horizontal layers of such thickness (not deeper than 18 inches) that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Placing shall be carried out at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited.

H. Concrete shall be consolidated with the aid of mechanical vibrators in conformance with ACI "Recommended Practice for Consolidation of Concrete" to produce a dense, homogeneous mass without voids or pockets. Vibrators should be placed in concrete rapidly so as to penetrate the entire previous lift, to blend the two layers. Vibrating techniques must assure that when the course aggregate reaches the form, it stops and the matrix fills the voids.

I. At horizontal joints of floor and roof beams where mechanically roughened and cleaned surfaces are required, thoroughly clean all foreign materials and laitance, roughen with suitable tools such as chipping hammers or wire brushes and reclean by stream of water or compressed air. New concrete shall be deposited before bonding agent dries out.

3.8 FINISHING OF CONCRETE SURFACES

A. The intent of this Specification is to secure for the job, materials and workmanship of such quality that only nominal finishing will be required to produce concrete surfaces equal to the best obtainable with the concrete and forming materials specified. Surfaces which reveal, upon removal of forms, imperfections of such magnitude as to seriously impair the appearance of the structure, in the opinion of the Architect, shall be deemed cause for rejection, and concrete members containing such imperfections shall be entirely removed and replaced without damage to adjacent materials or extra expense to the Owner. Lesser imperfections of concrete surfaces shall be patched and finished in accordance with the following procedures.

B. Patching - Areas to be patched shall not exceed 1.5 square feet for each 1000 square feet of surface area. Patches shall match in every respect, the color and texture of the surrounding surfaces. Mix formulation shall be determined by trial to obtain a color match when both the patch and the surrounding concrete are cured and dry. After initial set, surfaces of patches shall be textured manually to obtain a match with the surrounding surfaces. All patches are subject to Architect's final acceptance as to appearance and quality.

C. Exposed Vertical Surfaces - Immediately after removal of forms, chip off all fins, and other projections, and patch all voids, honeycombs, and air pockets exceeding 3/4" in any dimension. In areas where concentrations of small voids occur, patch a sufficient number of voids to produce a uniform appearance across the entire panel. Smooth out projections and fins with wet carborundum stones or power grinders to extent directed by Architect. Pull tie rods and pack voids formed by tie-rod cones to a point 3/4" from finish surface. Patch exposed irregular lines at edges of slab soffits to produce neat, uniform appearance.

D. All exposed concrete shall be thoroughly cleaned to remove stains, laitance, dust, form oil, and all other surface residue by use of water, stiff brushes, sandpaper or other means approved by the Architect.

E. Finishing of Concealed Concrete Surfaces - At surfaces to receive waterproofing membranes, chip off fins and other projections and trowel patch all voids, honeycombs and air pockets exceeding 1/2" in any dimension. Pull tie-rods and patch voids formed by tie-rod cones flush with adjacent surfaces. At outside faces of foundation walls, except for surfaces to receive waterproofing membranes, trowel patch all voids, honeycombs and air pockets exceeding 3/4" in depth. At other concealed surfaces, patching, if any, shall be as directed by the Architect and shall, in general, be only such as is required to assure or protect the structural integrity of concrete or reinforcing.

3.9 FLOOR AND OTHER FLATWORK FINISHES

A. Concrete for finish floor slabs shall be poured as dry as practicable within allowable slump range. Except when otherwise indicated or specified, concrete floor slabs shall be monolithically finished at required elevation by screeding floating, and troweling to provide a smooth, even, non-porous finish, free of finishing marks. Do not begin finish troweling until concrete has hardened sufficiently to prevent excess fines from working to the surface. Finish requirements for formed concrete slabs, concrete slabs on deck and concrete slabs on grade are as follows:

Scratch Finish: At areas to receive a bonded, applied cementitious application, finish base slab as indicated above, except bull floats or darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to ensure a permanent bond between base slab and applied cementitious materials.

Steel Trowel Finish: At areas to receive resilient floor covering or carpet, floors exposed to view, applied toppings and other interior surfaces, steel trowel immediately after floating. After initial troweling is complete and slabs have set sufficiently to ring the trowel, the surfaces shall be given a second steel troweling to a burnished finish.

Broom Finish: Provide edged and jointed broom finish for exposed concrete pavements, ramps, stairs, etc. Immediately following floating of surfaces to have broom finish, steel trowel the surface. Use a moistened, stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of

traffic. Repeat edging and jointing operations as required to obtain a distinct edge. Match texture approved by Architect from sample panel.

Float Finish: Slabs to receive unbonded toppings, steel trowel finish, mortar setting beds, equipment pads, etc. shall be floated to a smooth, dense, uniform, sandy textured finish. During floating, while surface is still soft, check surface flatness using a 10 foot highway straightedge. Correct high spots by cutting down and correct low spots by filling with material of the same composition as floor finish.

B. Concrete for formed floor slabs shall be poured to the proper elevations by adding concrete and/or by adjusting formwork supports to compensate for form and shoring deflections. Positive means of adjustment (wedges and jacks) of shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Slab thickness indicated on drawings is a minimum.

C. Concrete for floor slabs on metal deck shall be poured to the proper elevations by adding concrete to compensate for deck and structural member deflections. Composite steel beams are designed to be unshored. Slab thickness indicated on drawings is a minimum. Assume one and one quarter (1.25") inch additional thickness concrete at mid-bay required.

D. Concrete floor slabs shall conform to the following flatness and levelness tolerances per ASTM E1155 for Specified Overall Values (SOV) and Minimum Local Values (MLV):

Carpeted areas:

Floor Flatness Number F_F:
Specified Overall Value (SOV) = 25

Minimum Local Value (MLV) = 17

Floor Levelness Number F_L:
Specified Overall Value (SOV) = 20

Minimum Local Value (MLV) = 15

Exposed areas or areas to receive wood flooring, resilient flooring, or thin set tile:

Floor Flatness Number F_F:
Specified Overall Value (SOV) = 35

Minimum Local Value (MLV) = 25

Floor Levelness Number F_L:
Specified Overall Value (SOV) = 20

Minimum Local Value (MLV) = 15

Measurements shall be taken by the Testing Agency in accordance with ASTM E1155, as directed by the Architect. Measurements shall be taken within 72 hours of concrete placement to verify compliance with FF and FL requirements. Leveling of the slab by the Contractor to the required tolerances, if not achieved by initial finishing, shall be by machine grinding or by special leveling compound, or both, as approved by the Architect.

Note: Only F_F numbers are applicable to elevated reinforced concrete slabs and slabs on metal deck. Both F_F and $F_{L.}$ numbers are applicable to slabs on grade.

E. Elevation Tolerance: The top surface elevation of formed floor slabs, slab on metal deck and slabs on grade must not vary from the specified design elevation by more than +/- 3/8" (3/4" envelope), as measured at 80% of all points.

F. Concrete slab surfaces to be sloped shall be sloped uniformly to drains.

G. Concrete slabs to receive Portland cement setting beds or concrete or fills shall be given a rough wood float or broom finish.

H. Provide edged and jointed broom finish for exposed concrete pavements. Immediately following floating of surfaces to have broom finish, steel trowel the surface. Use a stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of traffic. Repeat edging and jointing operations as required to obtain a distinct edge.

I. No dry cement or mixture of sand and cement shall be applied to surface of any concrete slab to absorb moisture.

J. Protect floors from damage until completion of job.

3.10 SURVEY

A. The Contractor shall provide as-built surveys of concrete slabs at all levels in accordance with ASTM E1155 and ACI 117.

B. Surveys shall be taken prior to removal of shoring, as applicable.

C. Submit a summary of results at each level for review by the Architect. Additional readings may be requested, at the direction of the Architect. Floor leveling, if required, shall be as specified in Paragraphs 2.1 H and Section 3.11.

3.11 FLOOR LEVELING

A. Place self leveling concrete underlayment for floor leveling in accordance with manufacturer's recommendations:

1. Remove all dirt, grease, sealers, etc. from existing slab by sandblasting or power wash.

2. Prime and seal entire surface to receive topping. Use bonding agent, applied in strict conformance with manufacturer's instructions.

3. Pour or pump, mixed rough course of underlayment material onto primed area in accordance with manufacturer's instructions, filling areas to within 3/4 inch of finish elevation at mid-bay. This rough course shall consist of the underlayment material, mixed with fine gravel aggregate (3/8" maximum size), as applicable and as required by manufacturer.

4. After allowing rough course to set, prime with bonding agent and place finish course of underlayment material to within 1/4 inch of finish elevation at mid-bay. Protect newly applied underlayment from premature surface drying and moisture loss.

3.12 CURING AND PROTECTION

A. Protect newly placed concrete against low and high temperature effects and against rapid loss of moisture. Cure all concrete for at least seven (7) days at a temperature of at least 50 degrees F by curing methods approved by the Architect. Curing compounds shall not be used.

B. Vertical or near vertical surfaces may be cured by maintaining wood forms continuously wet during curing period, by wrapping with continuous .006" polyethylene with taped joints or as approved by the Architect.

C. Floor surfaces, after hardening sufficiently to prevent damage, and normally within several hours after final troweling, shall be covered with reinforced, waterproof kraft paper with taped, lapped seams.

3.13 FORM REMOVAL

A. Forms shall be removed without damage to concrete. The contractor shall be responsible for the safety of the construction during and after form removal. No act of the Architect shall relieve him of this responsibility.

B. Protect corners from damage after form removal by boxing, corner boards or other means approved by the Architect.

C. Formwork for pilasters, walls, and other parts not supporting the weight of concrete may be removed as soon as the concrete has reached 30% of its specified 28-day strength, but not before 2 days, provided it is properly cured and protected.

D. Formwork for beam soffits, slabs and other parts supporting the weight of concrete shall remain in place until the concrete has reached 100% of its specified 28-day strength except that after the concrete has reached 75% of its specified 28-day strength, but not before 7 days, the form work may be removed and the elements securely reshored.

E. Reshoring shall remain in place until concrete has reached its specified 28-day strength and until members can safely support their weight and load thereon. Until the 28-day strength has been achieved, all concrete shall be protected from shock, vibration and heavy loads.

F. Foundation walls to retain earth shall not be backfilled until the connecting slabs at the top and bottom of the wall have achieved their 28 day strength. Alternatively, the contractor may provide an engineered wall bracing system to withstand wall earth pressures during construction prior to slab bracing.

3.14 WATERSTOP

A. Install continuous Bentonite strip waterstop at vertical and horizontal below grade wall construction joints. Installation shall be in accordance with manufacturer's recommendations.

3.15 CUTTING OF HOLES

A. Holes required by other trades in any cast-in-place concrete which did not receive sleeves shall be cut by the respective trades. Use a core drilling process or sawing process which produces clean sharp edges and the minimum hole size which accommodates the piping, conduit, or equipment requiring the opening. Field locate all reinforcing bars prior to coring and do not cut bars.

B. Obtain approval of Architect before cutting any holes for any trades.

3.16 FLOOR HARDENING

A. All interior concrete floors remaining exposed in the finished work shall be treated with a chemical hardener in a three-coat application, not sooner than 28 days after pouring of slab, in accordance with manufacturer's specifications.

3.17 NON-SHRINK GROUT

A. Grout solid all column leveling plates and beam bearing plates in accordance with manufacturer's recommendations.

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SECTION 03 31 16
LIGHTWEIGHT CONCRETE TOPPINGS
(Balconies)

1.1 GENERAL

A. Related Documents:

1. **Concrete balcony deck topping to be part of a complete positive drainage waterproofing system including substrate preparation, waterproof membrane, preformed metal corners (inside and outside), threshold and edge flashing, edge "t-bar" weep system, end dam accessories, counter flashing, and all other accessories to provide a complete, warranted waterproof balcony system. All components of the system shall be submitted and approved in accordance with the requirements of Section 01 33 00. Comply with requirements of Section 07 13 00 Sheet Membrane Waterproofing for full assembly deck details and other topping requirements.**
2. Comply with requirements of Section "Cast-In-Place Light Weight Concrete" and as herein specified.

B. Submittals: Furnish data, samples, laboratory test reports and materials certificates as specified in Section "Cast-In-Place Light Weight Concrete."

1.2 PRODUCTS

A. Portland Cement: ASTM C 150, Type I or Type II.

B. Standard Aggregate: ASTM C 33, and as follows:

1. Fine aggregate consisting of sand or crushed stone~ screenings, clean, hard, free of deleterious matter.

C. Exterior Topping Design mix to produce topping material with following characteristics:

1. Mix design: 3000 psi minimum. Small rock pump mix specifically developed as part of the specified "Positive Drainage" balcony/breezeway concrete deck waterproofing system.
2. Slump: 3.0 to 6.0 inches.
3. W/C Ratio .55 maximum.

D. Mixing: Comply with system supplier/installers requirements, mixing instructions and installation procedures. Provide batch type mechanical mixer for mixing topping material at Project site. Equip batch mixer with a suitable charging hopper, water storage tank, and a water-measuring device. Use mixers that are capable of mixing aggregates, cement, and water into a uniform mix within specified time, and of discharging mix without segregation.

1. Ready-mixed topping complying with ASTM C 94 may be used when acceptable to Architect.

1.3 EXECUTION

A. Prior to placing topping mixture, dampen slab surface, but do not leave standing water.

B. Float Finish: Spread topping mixture evenly over prepared base to the required elevation and strike off Use highway straightedge, bull float, or darby to level surface. After the topping has stiffened

sufficiently to permit the operation and water sheen has disappeared, float surface at least twice to a uniform sandy texture. Re-straighten where necessary with highway straightedge. The surface shall achieve an F/F 20 and F[L 17 tolerance when tested in accordance with ASTM E 1155. Uniformly slope surface to drain.

C. Cure and protect topping applications and finishes as specified in Section "Cast-In-Place light Weight Concrete".

D. Performance Failure to concrete topping to bond to substrate (as evidenced by a hollow sound when tapped, disintegration, or other failure of topping to perform as a floor finish) will be considered failure of materials and workmanship. Repair or replace toppings in areas of such failures, as directed.

END OF SECTION 03 31 16

SECTION 03 31 30

CAST-IN-PLACE LIGHT WEIGHT CONCRETE

PART GENERAL

1.1 SECTION INCLUDES

A. The work of this Section consists of all plain and reinforced concrete work as shown on the Drawings and as specified herein, and includes, but is not limited to the following:

1. Furnishing, placing, curing and finishing of all plain light weight concrete work for the buildings.

2. Furnishing and installation of joint fillers.

3. Setting of anchor bolts and grouting of leveling plates and bearing plates.

4. Coordination with all other trades for location of all pipe sleeves, roof drains, floor drains, duct openings, keys, chases, electrical boxes and conduits, anchors, inserts, fastenings and other devices required by other trades.

5. Hardening and sealing of exposed light weight concrete floor toppings.

6. As-built surveys of concrete floor slab elevations.

7. Leveling of light weight concrete floor toppings.

1.2 REFERENCES (LATEST EDITIONS)

A. ASTM listed standards by the American Society for Testing and Materials.

B. ACI listed standards by the American Concrete Institute.

C. CRSI listed standards by the Concrete Reinforcing Steel Institute.

D. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.

E. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.3 SUBMITTALS

A. Submit complete Shop Drawings, Samples and other Data in accordance with the provisions of Section 01 33 00 - Submittals.

1. Shop Drawings:

a. Construction joint layout: Submit drawings showing proposed construction joint locations for all walls, slabs, slabs on metal deck, beams, etc. Drawings shall be submitted prior to preparation of reinforcement drawings.

b. Except as otherwise noted, approval of Shop Drawings will be for size and arrangement of components. Errors in dimensions shown on Shop Drawings shall be responsibility of Contractor.

c. Check and coordinate cast-in-place concrete work with work of other trades before submitting Shop Drawings.

d. **Submit plans for all levels with M.E.P. penetration sizes and locations for** approval prior to submitting reinforcing shop drawings.

e. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for us as Shop and Coordination Drawings is subject to the following conditions:

(1) The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from United Structural Consultants, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.

(2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.

(3) The User further agrees to release, indemnify, hold harmless and defend United Structural Consultants, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

2. Light Weight Concrete Constituents: Submit a detailed list of concrete materials and corresponding sources, proposed for use in concrete for this project. If conveying concrete by pump is requested by Contractor, related data regarding concrete materials, pumping devices and methods shall be submitted to Architect for approval three weeks before such method is proposed for use. Provide concrete mix data as specified in Paragraph 2.2B.

3. Methods of Construction: Prior to starting work, submit summary of methods, sequence of construction, and type of equipment proposed for use for performing cast-in-place concrete work. This submission shall not relieve Contractor of his responsibility for providing proper methods, equipment, workmanship and safety precautions.

4. Samples: Submit samples and/or descriptive literature of materials, products, and methods as noted herein, and as otherwise requested by the Architect: concrete constituents including admixtures; form ties and spreaders; accessories for reinforcement; reglets; non-shrink cement grout; inserts; form release agents and waterstops.

5. Concrete Curing and Protection: Submit summary of methods proposed for curing and protection of concrete.

6. Corrective Work: Submit drawings showing details of any proposed corrective work.

7. Affidavit: Submit, upon request by Architect, manufacturer's and/or supplier's and/or installer's affidavit stating that material or product provided complies with Contract Documents.

B. Provide light weight concrete Mix Data as specified in Paragraph 2.2B.

C. Provide manufacturer's data for other products.

D. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Contractor.

E. The Contractor is responsible for furnishing and installing materials called for in Contract Documents, even though these materials may have been omitted from approved Submittals.

1.5 QUALITY ASSURANCE

A. All materials, measuring, mixing, transportation, placing and curing shall be subject to inspection by the Architect or by the testing agency. However, such inspection, wherever conducted, shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of material or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.

B. A qualified testing agency for testing and inspection will be selected by the Owner and shall be paid directly by the Owner.

C. The Contractor shall retain the services of a qualified testing agency, approved by the Architect, to test aggregate and to prepare or review mix designs for each strength of concrete specified, and shall submit mix designs and test results to the Architect for approval. The costs of all such services shall be borne by the Contractor.

D. Advise the testing agency of intent to place concrete by notification at least 24 hours prior to the time of placement.

E. Concrete will be sampled and tested for quality control as follows:

1. ASTM C 172: Sampling fresh concrete.
2. ASTM C 31: Compression test specimens.
3. ASTM C 143: Slump
4. ASTM C 231: Air content
5. ASTM C 39: Compressive strength.

6. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Uses as a Mineral Admixture in Portland Cement Concrete.

7. ASTM C 311: Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

F. Cooperate with the testing agency's work and provide help as required for taking and storing samples. Provide storage facilities for concrete cylinders at the site. Facilities must protect cylinders from affects of low or high temperatures in cold or hot weather, respectively.

G. Compression tests shall consist of six (6) cylinders for each test made, cured and tested by the laboratory during the progress of the job. At least one (1) test shall be made for each strength of concrete up to 50 cubic yards pour, and at least one (1) test per strength for each 50 cubic yards thereafter, unless otherwise directed by the Architect. Concrete for each set of cylinders shall be from one (1) sample representative of the entire batch. All cylinders shall be standard 6" X 12".

H. In addition to the above, the Architect or the Contractor may direct additional control cylinders to be made, cured and tested to verify strengths for removal of forms, shoring or adequacy for curing or cold weather protection. In such instances, the cylinders shall be cured in the same environment as the area which the cylinders represent. All such additional work requested by the Contractor shall be at his own expense.

I. Evaluation of Compression Tests:

1. Architect has authority to order, for any strength of concrete, increase in cement content and mix redesign for remaining work of either:

a. Average 7-day strength of any two consecutive tests representing a particular design strength of a class of concrete is less than 55 percent of specified strength; OR

b. Average 28-day strength of any two consecutive tests representing particular design strength of a class of concrete is less than 90 percent of specified strength.

2. The strength level of a class of concrete shall be considered satisfactory, if the following requirements are met:

a. Averages of any three consecutive 28-day strength tests representing each class of concrete equal or exceed the specified strength (f'c).

b. Not more than 10 percent of 28-day strength tests have values less than the specified strength (f'c).

c. No individual 28-day test shows an average strength less than 90 percent of specified strength (f'c).

3. When tests of control specimens fall below the strength level requirements, the Architect may require core specimens taken from concrete in question and tested in accordance with ASTM C 42. If these specimens do not meet the strength requirements, the Architect will have the right to require additional curing, load tests, strengthening or removal and replacement of those parts of the structure which are unacceptable, and in addition, removal of such sound portions of

structure as necessary to insure safety, appearance and durability of the structure. Additional testing, load tests, strengthening or removal and replacement of parts of the structure and any costs associated with redesign or delay of the project shall be at the Contractor's expense.

K. Upon completion of concrete testing for the project the testing agency shall compile all results and perform a statistical strength analysis for each class of concrete in accordance with ACI 214.

L. Accept as final, results of tests made by the qualified professional testing organization engaged by the Owner.

M. Testing required because of changes requested by the Contractor in materials, sources of materials or mix proportions, and extra testing of concrete or materials because of failure to meet the Specification requirements is to be paid by the Contractor.

N. A final report shall be issued by the testing agency following the completion of work in this Section stating that all deficiencies have been corrected.

1.6 NOTIFICATION OF RELATED TRADES

A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, louvers, etc. when ready for such installation, and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.

B. Leave openings in walls for pipes, ducts, etc. for mechanical and electrical work, as shown on Drawings or required by layout of mechanical systems.

1.7 SUBSTITUTIONS

A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the following conditions:

1. That request has been made and accepted prior to submission of Shop Drawings.
2. That there is a substantial cost advantage and/or time advantage to the Owner.
3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect, including cost reductions or savings in time to complete work.

PART 2- PRODUCTS

2.1 MATERIALS

A. Cement

1. Portland Cement - ASTM C 150, Type I or II.
2. Fly Ash – ASTM C 618 Class F.

B. Natural Aggregate

1. Coarse aggregate: Shall be hard, durable, uncoated crushed stone or washed gravel conforming to ASTM C 33 and the following additional requirements.
Nominal Size: 3/4" (Use 3/8" aggregate at topping slabs 3 inches or less in thickness or at areas of closely spaced reinforcing.)
Fineness Modulus: (+/- 0.20) 6.70 and 5.5 respectively
Organic: Plate 1 maximum.
Silt: 1.0 % maximum
Soundness: 5% - 8% maximum loss, magnesium sulfate, five cycles.

2. Fine Aggregate: Shall be sand, clean, hard, durable, uncoated grains, free from silt, loam and clay, to meet ASTM C 33 and the following additional requirements:

Sieve	Retained Percent
#4	0-5
#16	25-40
#50	70-87
#100	93-97

Fineness Modulus: 2.8 (+/- 0.20)
Organic: Plate 2 maximum
Silt: 2.0% maximum
Soundness: 5% - 10% maximum loss, magnesium sulfate, five cycles.

C. Water

1. Water shall be from the local municipal supply.

D. Admixtures

1. Water-reducing Agent shall conform to ASTM C 494, Type A. Water-reducing agent shall be compatible with air-entraining agent.

2. Superplasticizer shall conform to ASTM C494, Type F or Type G. Superplastizer shall be compatable with the other admixtures.

3. Air-entraining agent shall conform to ASTM C 260.

4. Calcium Chloride or admixtures containing more than 0.1% Chloride ions are not permitted.

5. Accessories touching formed surfaces exposed to view shall have not less than 1/4 inch of high density polyethylene between metal and concrete surface. Plastic tips shall extend not less than 1/2 inch up on metal legs.

E. Formwork

1. Forms for concrete surfaces not exposed to view, shall be made of wood, metal, or other material subject to approval of Architect.

2. Form release agent shall be of a non-staining type, specifically manufactured for concrete forms.

3. Forms for smooth surfaces exposed to view or to receive a skin coat of plaster and/or paint shall be smooth and subject to approval of the architect by way of a mockup test panel.

4. Form ties shall be factory-fabricated, removable or snap back of approved design. Wire shall be at least 1-1/2" back from exterior surfaces and 1" from interior surfaces.

5. Chamfer strips shall be one-half inch, 45 degree wood strips, or as detailed, nailed six inches on center, and installed at inside corners of all forms, unless otherwise directed by the Architect.

6. Reglets shall be formed from 24 gauge galvanized steel and shall be of type shown on Drawings or appropriate for use intended. Metal reglets shall be used merely as form to obtain desired profile. After concrete has set, remove reglets.

F. Bonding agent for bonding new concrete to existing concrete at construction joints shall be Sikadur 32, Hi-Mod by Sika Corporation or equal approved by the Architect.

G. Self Leveling Concrete Underlayment

1. Concrete underlayment used for floor leveling shall be SikaSet by Sika Corporation, Ardex K-15 by Ardex, Inc., Bonsal Self Leveling Wear Topping by W. R. Bonsal Company or equal approved by Architect. For feather finish areas use Ardex SD-F or equal approved by the Architect.

2. Aggregate shall be well-graded, washed fine gravel (1/8 inch to 1/4 inch or larger) for use when underlayment is installed over 1/2 inch thick.

3. Gypsum based underlayment products are not allowed.

H. Surface Conditioners

1. Floor Hardener for exposed concrete floors shall be “Liqui-Hard” by W.R. Meadows, Inc. or equal approved by the Architect.

I. Other Materials:

1. Joint filler where used with caulking or sealants, shall be cork type, non-extruding, self-expanding filler strips conforming to ASTM D 1752, III. Where no sealant or caulking is required, strips shall be closed cell flexible polyethylene type conforming to ASTM D 1752. Joint fillers for exterior paving shall be non-extruding bituminous type in accordance with ASTM D 1751.

2. Flexible epoxy joint sealant shall be Sikadur 51 NS/SL by Sika Corporation, or approved equal.

3. Threaded Inserts: Richmond Screw Anchor Co. or equal structural concrete inserts of type shown on Drawings. Galvanize all components in accordance with ASTM A 153.

4. Waterproof Kraft Paper shall be in accordance with ASTM C 171.

5. Waterstops shall be bentonite strip type Waterstop – RX, manufactured by Cetco or equal as approved by the Architect.

6. Non-Shrink Grout: Shall be "SetGrout" by Master Builders, "Sono Grout" by Sonneborn Contech, Inc. "Five Star Grout" by U.S. Grout Corporation or equal approved by the Architect.

7. Dovetail Anchor Slots shall be formed of not less than 20 gauge hot dipped galvanized steel, 1" by 1" and furnished with felt or fiber fillers.

2.2 LIGHT WEIGHT CONCRETE MIXES

A. Strength, cement and water requirements:

Design Compr. Strength, f'c	Min. Cement Factor*	Max. Water Cement Ratio	Sacks/yd3 lbs/yd3	Gal/sack Gal by wt.
2500	470	0.62	7.0	5.0
3000	517	0.57	6.5	5.5

*Fly Ash may be used in all concrete except exterior walks and retaining walls. Amount may be up to approximately 20% of the total cement content.

B. All concrete shall be proportioned in accordance with ACI Standard 211.1, "Recommended Practice for Selecting Proportion for Normal and Heavyweight Concrete" and comply with the requirements of ACI 301 "Specifications for Structural Concrete" Chapter 3, Method 1 (trial batches) or 2 (field experience).

C. Air-entraining and water-reducing agents shall be used in all concrete, in strict accordance with the manufacturer's printed instructions. Total air entrained in freshly mixed interior concrete shall be 4.0% plus or minus 1.0% of volume of concrete with required strengths maintained, except that all interior slabs subject to abrasion shall have a maximum air content of 3% and all exterior concrete subjected to freezing and thawing shall have an air content of 5% plus or minus 1%.

D. Water-Cement Ratio - All concrete subjected to freezing and thawing shall have a maximum water-cement ratio of 0.49 (f'c = 4000 psi minimum). All concrete required to be watertight and/or subjected to de-icers shall have a maximum water-cement ratio of 0.45 (f'c = 4500 psi minimum). This is a total water in mix at time of placement, including free water of aggregates and liquid admixtures.

E. Slump of concrete shall be 4" (+/-1"). If a superplasticizer is used, the slump shall be 3" (+/-1") prior to adding the superplasticizer and 8" (+/-1") after adding the superplasticizer.

F. Premix admixtures in solution form and dispense as recommended by the manufacturer. Include the water in the solution in the design water content of the mixtures.

PART 3 EXECUTION

3.1 STORAGE

A. All materials shall be stored to prevent damage from the elements and other causes.

B. Cement and aggregates shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Any materials which have deteriorated, or which have been damaged, shall not be used for concrete.

C. Store reinforcing steel on wood skids to protect it from earth and damage from trucking or other construction operations. Reinforcement shall be free from loose mill scale, rust, release agent, concrete splatter and other extraneous coatings at the time it is embedded in the concrete.

D. All forms shall be stored in neat manner and orderly fashion, protected from the weather and abuse.

E. Materials which are judged not acceptable for this project shall not be stored on the site, but shall be immediately removed from the site.

3.2 FORMING

A. Formwork construction shall be as specified in ACI 347 "Guide to Formwork for Concrete".

B. Acceptable tolerances shall be as specified in ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials”. Concrete formed surfaces not exposed to view shall conform to Class C requirements.

C. Forms shall be constructed to conform to shapes, lines, and dimensions shown, plumb and straight, and shall be maintained sufficiently rigid to prevent deformation under load. Forms shall be sufficiently tight to prevent the leakage of grout. Securely brace and shore forms to prevent displacement and to safely support the construction loads.

D. Treat forms with a form release agent applied according to the manufacturer's instructions, by roller, brush or spray to produce a uniform thin film without bubbles or streaks. Apply the release agent in two coats for the first use of the form and in one coat for each additional use.

3.3 MIXING PROCESS

A. Ready-mixed concrete shall be mixed and transported in accordance with "Specification for Ready-Mixed Concrete" ASTM C 94, Alt. #3 and ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".

3.6 JOINTS

Provide construction joints as shown on the Drawings, but in any case limit the maximum dimensions for placement of concrete in any one placement as follows:

1.	Walls:	80 feet
2.	Reinforced slabs, beams:	100 feet
3.	Slabs-on-grade:	100 feet
4.	Slabs on Metal Deck:	100 feet

B. Construction joints shall be formed with keyed bulkheads. Reinforcement shall continue through the joint, and additional reinforcement shall be placed as indicated on the Drawings.

C. Provide control joints as shown on the Drawings, but in any case limit the maximum dimensions between joints as follows:

1.	Slabs-on-grade:	25 feet

D. Control joints shall be saw cut, as early as practical, the day after placement and finishing of concrete. Discontinue 50% of the reinforcement at the joint. Do not place control joints in slabs on metal deck.

3.7 PLACING

A. Notify the Architect and Structural Engineer at least 72 hours prior to each placement.

B. Do not place concrete until soil bearing material, reinforcing steel, inserts, sleeves and other work to be built into the concrete have been inspected and approved by the Architect and all trades concerned.

C. In hot weather, all concreting shall be done in accordance with ACI 305, "Recommended Practice for Hot Weather Concreting".

1. When temperature rises above 70 degrees F, all surfaces of concrete shall be protected against rapid drying.

2. Concrete delivered to the forms shall have a temperature of not over 90 degrees F.

3. The temperature of the forms shall not be over 90 degrees F.

D. In cold weather, all concreting shall be done in accordance with ACI 306, "Recommended Practice for Cold Weather Concreting".

1. When the average daily temperature falls below 40 degrees F, all surfaces of concrete shall be maintained at a temperature of at least 50 degrees F and not over 90 degrees F for seven (7) days.

2. Concrete delivered to the forms shall have a temperature of at least 60 degrees F and not over 90 degrees F.

3. The temperature of the forms including gravel base, shall be at least 40 degrees F.

4. The Contractor shall maintain a record of temperature of the concrete at the most exposed surfaces of each placement at the beginning and at the end of each day of the curing period, which shall be available to the Architect.

E. Conveying - Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is retained.

F. Depositing - Delivery and placement of concrete shall be programmed so that the time lapse between batching and placement shall not exceed 1-1/2 hours. Concrete shall not be allowed a free fall of over 4 feet. Concrete shall be deposited as nearly as practicable in its final position, to avoid segregation due to rehandling or flowing.

G. Concrete shall be deposited continuously, in horizontal layers of such thickness (not deeper than 18 inches) that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Placing shall be carried out at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited.

H. Concrete shall be consolidated with the aid of mechanical vibrators in conformance with ACI "Recommended Practice for Consolidation of Concrete" to produce a dense, homogeneous mass without voids or pockets. Vibrators should be placed in concrete rapidly so as to penetrate the entire previous lift, to blend the two layers. Vibrating techniques must assure that when the course aggregate reaches the form, it stops and the matrix fills the voids.

I. At horizontal joints of floor and roof beams where mechanically roughened and cleaned surfaces are required, thoroughly clean all foreign materials and laitance, roughen with suitable tools such as chipping hammers or wire brushes and reclean by stream of water or compressed air. New concrete shall be deposited before bonding agent dries out.

3.8 FINISHING OF CONCRETE SURFACES

A. The intent of this Specification is to secure for the job, materials and workmanship of such quality that only nominal finishing will be required to produce concrete surfaces equal to the best obtainable with the concrete and forming materials specified. Surfaces which reveal, upon removal of forms, imperfections of such magnitude as to seriously impair the appearance of the structure, in the opinion of the Architect, shall be deemed cause for rejection, and concrete members containing such imperfections shall be entirely removed and replaced without damage to adjacent materials or extra expense to the Owner. Lesser imperfections of concrete surfaces shall be patched and finished in accordance with the following procedures.

B. Patching - Areas to be patched shall not exceed 1.5 square feet for each 1000 square feet of surface area. Patches shall match in every respect, the color and texture of the surrounding surfaces. Mix formulation shall be determined by trial to obtain a color match when both the patch and the surrounding concrete are cured and dry. After initial set, surfaces of patches shall be textured manually to obtain a match with the surrounding

surfaces. All patches are subject to Architect's final acceptance as to appearance and quality.

C. Exposed Vertical Surfaces - Immediately after removal of forms, chip off all fins, and other projections, and patch all voids, honeycombs, and air pockets exceeding 3/4" in any dimension. In areas where concentrations of small voids occur, patch a sufficient number of voids to produce a uniform appearance across the entire panel. Smooth out projections and fins with wet carborundum stones or power grinders to extent directed by Architect. Pull tie rods and pack voids formed by tie-rod cones to a point 3/4" from finish surface. Patch exposed irregular lines at edges of slab soffits to produce neat, uniform appearance.

D. All exposed concrete shall be thoroughly cleaned to remove stains, laitance, dust, form oil, and all other surface residue by use of water, stiff brushes, sandpaper or other means approved by the Architect.

E. Finishing of Concealed Concrete Surfaces - At surfaces to receive waterproofing membranes, chip off fins and other projections and trowel patch all voids, honeycombs and air pockets exceeding 1/2" in any dimension. Pull tie-rods and patch voids formed by tie-rod cones flush with adjacent surfaces. At outside faces of foundation walls, except for surfaces to receive waterproofing membranes, trowel patch all voids, honeycombs and air pockets exceeding 3/4" in depth. At other concealed surfaces, patching, if any, shall be as directed by the Architect and shall, in general, be only such as is required to assure or protect the structural integrity of concrete or reinforcing.

3.9 FLOOR AND OTHER FLATWORK FINISHES

A. Concrete for finish floor slabs shall be poured as dry as practicable within allowable slump range. Except when otherwise indicated or specified, concrete floor slabs shall be monolithically finished at required elevation by screeding floating, and troweling to provide a smooth, even, non-porous finish, free of finishing marks. Do not begin finish troweling until concrete has hardened sufficiently to prevent excess fines from working to the surface. Finish requirements for formed concrete slabs, concrete slabs on deck and concrete slabs on grade are as follows:

Scratch Finish*:* At areas to receive a bonded, applied cementitious application, finish base slab as indicated above, except bull floats or darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to ensure a permanent bond between base slab and applied cementitious materials.

Steel Trowel Finish*:* At areas to receive resilient floor covering or carpet, floors exposed to view, applied toppings and other interior surfaces, steel trowel immediately after floating. After initial troweling is complete and slabs have set sufficiently to ring the trowel, the surfaces shall be given a second steel troweling to a burnished finish.

Broom Finish*:* Provide edged and jointed broom finish for exposed concrete pavements, ramps, stairs, etc. Immediately following floating of surfaces to have broom finish, steel

trowel the surface. Use a moistened, stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of traffic. Repeat edging and jointing operations as required to obtain a distinct edge. Match texture approved by Architect from sample panel.

Float Finish: Slabs to receive unbonded toppings, steel trowel finish, mortar setting beds, equipment pads, etc. shall be floated to a smooth, dense, uniform, sandy textured finish. During floating, while surface is still soft, check surface flatness using a 10 foot highway straightedge. Correct high spots by cutting down and correct low spots by filling with material of the same composition as floor finish.

B. Concrete for formed floor slabs shall be poured to the proper elevations by adding concrete and/or by adjusting formwork supports to compensate for form and shoring deflections. Positive means of adjustment (wedges and jacks) of shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Slab thickness indicated on drawings is a minimum.

C. Concrete for floor slabs on metal deck shall be poured to the proper elevations by adding concrete to compensate for deck and structural member deflections. Composite steel beams are designed to be unshored. Slab thickness indicated on drawings is a minimum. Assume one and one quarter (1.25") inch additional thickness concrete at mid-bay required.

D. Concrete floor slabs shall conform to the following flatness and levelness tolerances per ASTM E1155 for Specified Overall Values (SOV) and Minimum Local Values (MLV):

Carpeted areas:

Floor Flatness Number F_F:
Specified Overall Value (SOV) = 25

Minimum Local Value (MLV) = 17

Floor Levelness Number F_L:
Specified Overall Value (SOV) = 20

Minimum Local Value (MLV) = 15

Exposed areas or areas to receive wood flooring, resilient flooring, or thin set tile:

Floor Flatness Number F_F:
Specified Overall Value (SOV) = 35

Minimum Local Value (MLV) = 25

Floor Levelness Number F_L:
Specified Overall Value (SOV) = 20

Minimum Local Value (MLV) = 15

Measurements shall be taken by the Testing Agency in accordance with ASTM E1155, as directed by the Architect. Measurements shall be taken within 72 hours of concrete placement to verify compliance with FF and FL requirements. Leveling of the slab by the Contractor to the required tolerances, if not achieved by initial finishing, shall be by machine grinding or by special leveling compound, or both, as approved by the Architect.

Note: Only F_F numbers are applicable to elevated reinforced concrete slabs and slabs on metal deck. Both F_F and $F_{L.}$ numbers are applicable to slabs on grade.

E. Elevation Tolerance: The top surface elevation of formed floor slabs, slab on metal deck and slabs on grade must not vary from the specified design elevation by more than +/- 3/8" (3/4" envelope), as measured at 80% of all points.

F. Concrete slab surfaces to be sloped shall be sloped uniformly to drains.

G. Concrete slabs to receive Portland cement setting beds or concrete or fills shall be given a rough wood float or broom finish.

H. Provide edged and jointed broom finish for exposed concrete pavements. Immediately following floating of surfaces to have broom finish, steel trowel the surface. Use a stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of traffic. Repeat edging and jointing operations as required to obtain a distinct edge.

I. No dry cement or mixture of sand and cement shall be applied to surface of any concrete slab to absorb moisture.

J. Protect floors from damage until completion of job.

3.10 SURVEY

A. The Contractor shall provide as-built surveys of concrete slabs at all levels in accordance with ASTM E1155 and ACI 117.

B. Surveys shall be taken prior to removal of shoring, as applicable.

C. Submit a summary of results at each level for review by the Architect. Additional readings may be requested, at the direction of the Architect. Floor leveling, if required, shall be as specified in Paragraphs 2.1 H and Section 3.11.

3.11 FLOOR LEVELING

A. Place self leveling concrete underlayment for floor leveling in accordance with manufacturer's recommendations:

1. Remove all dirt, grease, sealers, etc. from existing slab by sandblasting or power wash.

2. Prime and seal entire surface to receive topping. Use bonding agent, applied in strict conformance with manufacturer's instructions.

3. Pour or pump, mixed rough course of underlayment material onto primed area in accordance with manufacturer's instructions, filling areas to within 3/4 inch of finish elevation at mid-bay. This rough course shall consist of the underlayment material, mixed with fine gravel aggregate (3/8" maximum size), as applicable and as required by manufacturer.

4. After allowing rough course to set, prime with bonding agent and place finish course of underlayment material to within 1/4 inch of finish elevation at mid-bay. Protect newly applied underlayment from premature surface drying and moisture loss.

3.12 CURING AND PROTECTION

A. Protect newly placed concrete against low and high temperature effects and against rapid loss of moisture. Cure all concrete for at least seven (7) days at a temperature of at least 50 degrees F by curing methods approved by the Architect. Curing compounds shall not be used.

B. Vertical or near vertical surfaces may be cured by maintaining wood forms continuously wet during curing period, by wrapping with continuous .006" polyethylene with taped joints or as approved by the Architect.

C. Floor surfaces, after hardening sufficiently to prevent damage, and normally within several hours after final troweling, shall be covered with reinforced, waterproof kraft paper with taped, lapped seams.

3.14 WATERSTOP

A. Install continuous Bentonite strip waterstop at vertical and horizontal below grade wall construction joints. Installation shall be in accordance with manufacturer's recommendations.

3.15 CUTTING OF HOLES

A. Holes required by other trades in any cast-in-place concrete which did not receive sleeves shall be cut by the respective trades. Use a core drilling process or sawing process which

produces clean sharp edges and the minimum hole size which accommodates the piping, conduit, or equipment requiring the opening. Field locate all reinforcing bars prior to coring and do not cut bars.

B. Obtain approval of Architect before cutting any holes for any trades.

3.16 FLOOR HARDENING

A. All interior concrete floors remaining exposed in the finished work shall be treated with a chemical hardener in a three-coat application, not sooner than 28 days after pouring of slab, in accordance with manufacturer's specifications.

3.17 NON-SHRINK GROUT

A. Grout solid all column leveling plates and beam bearing plates in accordance with manufacturer's recommendations.

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SECTION 03 38 00

POST-TENSIONED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes post-tensioning reinforcement and accessories and post-tensioning operations including stressing.

1.2 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site. Review methods and procedures related to installation and stressing of post-tensioning tendons including, but not limited to, the following:

1. Construction schedule and availability of materials, personnel, and equipment needed to make progress and avoid delays.
2. Storage of post-tensioning materials on –site.
3. Structural load limitations.
4. Coordination of post-tensioning installation drawings and non-prestressed reinforcing steel placing drawings.
5. Horizontal and vertical tolerances on tendon and non-prestressed reinforcement placement.
6. Marking and measuring of elongations.
7. Submittal of stressing records and requirements for tendon finishing.
8. Removal of formwork.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Post-tensioning coating.
2. Tendon sheathing.
3. Anchorage devices.
4. Tendon couplers.
5. Bar and tendon supports.
6. Pocket formers.
7. Sheathing repair tape.
8. Stressing pocket patching material.
9. Encapsulation system.

B. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing tendon layout and installation procedures, including the following but not limited to the following:

1. Details of the encapsulated post-tensioning system, information about the stressing equipment, jacking forces, jack calibration information.
2. Number, arrangement, and designation of post-tensioning tendons.

3. Tendon profiles and method of tendon support including chair heights and locations.Show tendon profiles at sufficient scale to clearly indicate all support points, with their associated heights.
4. Construction joint location, pour sequence, locations of anchorages and any blockouts required for stressing.
5. Stressing procedures and jacking force to result in final effective forces used in determining number of tendons required.
6. Calculated elongations for each tendon.
7. Details for horizontal curvature around openings and at anchorages.
8. Details for corners and other locations where tendon layouts may conflict with one another or non-prestressed reinforcing steel.
9. Diagrams and notes as necessary for positioning of non-prestressed reinforcement required for installing post-tensioning tendons including, but not limited to the following:
    a. Support bars.
    b. Backup bars and hairpins at anchorages.
    c. Hairpins at locations of horizontal curvature.
    d. Supplemental reinforcement at blockouts.
10. Post-tensioning supplier is responsible for the design of the anchorage zone (local and general zone) reinforcement in accordance with ACI 318-latest edition. Details of the non-prestressed reinforcement in the anchorage zone for all members shall be shown on the shop drawings.

C. Delegated-Design Submittal: For post-tensioning system.
1. Sealed design calculations prepared by a qualified structural engineer indicating method of elongation calculation including values used for friction coefficients, anchorage seating loss, elastic shortening, creep, relaxation, and shrinkage.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Product certificates.
C. Mill Test Reports: For prestressing strand.
D. Field quality-control reports.
E. Stressing Records: Submit the same day as stressing operations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Fabricating plant certified by PTI according to procedures set forth in PTI's "Manual for Certification of Plants Producing Unbonded Single Strand Tendons."
B. Installer Qualifications: A qualified installer whose full-time Project superintendent has successfully completed PTI's Level 1 - Field Fundamentals course or has equivalent verifiable experience and knowledge acceptable to Architect.
    1. Superintendent must receive training from post-tensioning supplier in the operation of stressing equipment to be used on Project.
C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1. Testing Agency Inspector: Personnel performing field inspections and measuring elongations shall have successfully completed PTI's Level 1 - Field Fundamentals course or shall have equivalent verifiable experience and knowledge acceptable to Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle post-tensioning materials according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
B. Inspect tendons and accessory items at time of their delivery to Project site, prior to off-loading. Notify post-tensioning supplier of observed damage prior to off-loading.
C. Keep accurate and current records of materials delivered and used.
D. Immediately remove from Project site any tendons with damaged strand.

1.7 COORDINATION

A. Attachments and Penetrations:
1. Attach permanent fixtures such as handrails, fire-protection equipment, lights, and security devices to the slab using embedded anchors. Drilled anchors are not allowed unless authorized in writing by Architect.
2. Power-driven fasteners are not allowed unless authorized in writing by Architect.
3. Core drilling for sleeves or other penetrations is not allowed unless authorized in writing by Architect.
4. Protect penetrations within 18 inches of an anchorage with ASTM A 53/A 53M, Schedule 40 steel pipe.

PART 2 – PRODUCTS

2.1 PRESTRESSING TENDONS

A. ACI Publications: Comply with ACI 423.6, "Specification for Unbonded Single Strand Tendons," and ACI 301-10 “Specifications for Structural Concrete” unless otherwise indicated in the Contract Documents.
B. PTI Publications: Comply with PTI, “Design of Post-Tensioned Slabs-on Ground” third edition.
C. Prestressing Strand: ASTM A 416/A 416M, Grade 270, uncoated, seven-wire, low-relaxation, 0.5-inch diameter strand.
D. Post-Tensioning Coating: Compound with friction-reducing, moisture-displacing, and corrosion inhibiting properties; chemically stable and nonreactive with prestressing steel, nonprestressed reinforcement, sheathing material, and concrete.
E. Tendon Sheathing:
1. Minimum Thickness: 0.050 inch for polyethylene or polypropylene with a minimum density of 0.034 lb/cu. in..
2. Continuous over length of tendon to provide watertight encapsulation of strand.

F. Anchorage Device and Coupler Assembly: Assembly of strand, wedges, and anchorage device or coupler complying with static and fatigue testing requirements and capable of developing 95 percent of actual breaking strength of strand.

G. Encapsulation System: Posilock plus encapsulation system or equal. Watertight encapsulation of prestressing strand consisting of the following:

1. Wedge-Cavity Caps: Attached to anchorages with a positive mechanical connection and completely filled with post-tensioning coating.
2. Sleeves: Attached to anchorage device with positive mechanical connection; overlapped a minimum of 4 inches with sheathing and completely filled with posttensioning coating.

2.2 NONPRESTRESSED STEEL BARS

A. Support Bars, Reinforcing Bars, Hairpins:

1. Steel: ASTM A 615/A 615M, Grade 60, deformed.
2. Low-Alloy Steel: ASTM A 706/A 706M, deformed.

B. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening tendons and tendon support bars in place. Manufacture bar supports, according to CRSI's "Manual of Standard Practice," from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

1. For uncoated bars, use all-plastic bar supports.

2.3 ACCESSORIES

A. Pocket Formers: Capable of completely sealing wedge cavity; sized to provide the required cover over the anchorage and allow access for cutting strand tail.

B. Anchorage Fasteners: Stainless-steel nails, wires, and screws used to attach anchorage devices to formwork.

C. Sheathing Repair Tape: Elastic, self-adhesive, moisture proof tape with minimum width of 2 inches, in contrasting color to tendon sheathing; nonreactive with sheathing, coating, or prestressing steel.

2.4 PATCHING MATERIAL

A. One-component, polymer-modified, premixed patching material containing selected silica aggregates and portland cement, suitable for vertical and overhead applications. Do not use material containing chlorides or other chemicals known to be deleterious to prestressing steel or material that is reactive with prestressing steel, anchorage device material, or concrete.

PART 3 – EXECUTION

3.1 FORMWORK

A. Provide formwork for post-tensioned elements as specified in Section 033000 "Cast-in-Place Concrete." Design formwork to support load redistribution that may occur during

stressing operation. Ensure that formwork does not restrain elastic shortening, camber, or deflection resulting from application of prestressing force.

B. Do not remove forms supporting post-tensioned elements until tendons have been fully stressed and elongations have been approved by Architect.

C. Do not place concrete in supported floors until tendons on supporting floors have been stressed and elongations have been approved by Architect.

3.2 NONPRESTRESSED STEEL REINFORCEMENT PLACEMENT

A. Placement of nonprestressed steel reinforcement is specified in Section 033000 "Cast-in-Place Concrete." Coordinate placement of nonprestressed steel reinforcement with installation of posttensioning tendons.

3.3 TENDON INSTALLATION

A. Install tendons according to installation drawings and procedures stated in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."

1. Tolerances: Comply with tolerances in ACI 301 latest edition for beams and slabs.

B. Tendon Spacing: Uniform direction tendons shall be spaced at no more than the smaller of eight times slab thickness or 48 inches.

1. Support tendons as required to provide profiles shown on installation drawings. Position supports at high and low points and at intervals not exceeding 42 inches with continuous slab bolsters or bars supported on individual high chairs. Ensure that tendon profiles between high and low points are smooth parabolic curves and that tendons remain in their designated positions during construction and concrete placement.
2. Attach tendons to supporting chairs and reinforcement without damaging tendon sheathing.
3. Support slab tendons independent of beam reinforcement.

C. Maintain tendon profile within maximum allowable deviations from design profile as follows:

1. 1/4 inch for member depth less than or equal to 8 inches.
2. 3/8 inch for member depth greater than 8 inches and less than or equal to 24 inches.
3. 1/2 inch for member depth greater than 24 inches.

D. Maintain minimum radius of curvature of 480-strand diameters for lateral deviations to avoid openings, ducts, and embedded items. Maintain a minimum of 2 inches of separation between tendons at locations of curvature.

E. Limit tendon bundles to four tendons in slabs and six tendons in beams. Do not twist or entwine tendons within a bundle. Maintain a minimum distance of 12 inches between center of adjacent bundles in bands.

F. If tendon locations conflict with nonprestressed reinforcement or embedded items, tendon placement governs. Obtain Architect's approval before relocating tendons or tendon anchorages that interfere with one another.

G. Deviations in horizontal spacing and location of slab tendons are permitted when required to avoid openings and inserts.

H. Installation of Anchorage Devices:
1. Place anchorage devices at locations shown on approved installation drawings.
2. Do not switch fixed- and stressing-end anchorage locations unless approved by Architect.
3. Attach pocket formers, intermediate anchorage devices, and stressing-end anchorage devices securely to bulkhead forms. Install stressing-end and intermediate anchorage devices perpendicular to tendon axis.
4. Install tendons straight, without vertical or horizontal curvature, for a minimum of 12 inches behind stressing-end and intermediate anchorages.
5. Embed intermediate anchorage devices at construction joints in first concrete placed at joint.
6. Minimum splice length in reinforcing bars at anchorages is 24 inches. Stagger splices a minimum of 60 inches.
7. Place fixed-end anchorage devices in formwork at locations shown on installation drawings. Support anchorages firmly to avoid movement during concrete placement.
8. Remove loose caps on fixed-end anchorages, refill with post-tensioning coating, and reattach caps to achieve a watertight enclosure if necessary.

I. Maintain minimum concrete cover according to ACI 423.6 and ACI 301 latest edition

J. Maintain minimum clearance of 6 inches between tendons and openings.

K. Prior to concrete placement, mark tendon locations on formwork with spray paint.

L. Do not install sleeves within 36 inches of anchorages after tendon layout has been inspected.

M. Do not install conduit, pipe, or embeds requiring movement of tendons after tendon layout has been inspected.

N. Do not use couplers unless location has been approved by Architect.

3.4 SHEATHING INSPECTION AND REPAIR

A. Inspect sheathing for damage after installing tendons. Repair damaged areas by restoring posttensioning coating and repairing or replacing tendon sheathing.
1. Ensure that sheathing is watertight and there are no air voids.
2. Follow tape repair procedures in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."

B. Maximum length of exposed strand behind anchorages is as follows:
1. Fixed End: 12 inches.
2. Intermediate and Stressing End: 1 inch
   a. Cover exposed strand with sheathing repair tape to prevent contact with concrete.

C. Immediately remove and replace tendons that have damaged strand.

3.5 CONCRETE PLACEMENT

A. Place and finish concrete as specified in Section 033000 "Cast-in-Place Concrete." Ensure adequate consolidation of concrete around anchorages.

B. Do no place concrete until placement of tendons and nonprestressed steel reinforcement has been inspected by special inspector.
C. Provide Engineer, testing agency, and special inspector a minimum of 48 hour notice before concrete placement.
D. Ensure that position of tendon and nonprestressed-steel reinforcement does not change during concrete placement. Reposition tendons and nonprestressed-steel reinforcement moved during concrete placement to original location.
E. Ensure that method of concrete placement does not damage tendon sheathing. Do not support pump lines, chutes, or other concrete-placing equipment on tendons.

3.6 TENDON STRESSING

A. Calibrate stressing jacks and gages at start of project and at least every six months thereafter. Keep copies of calibration certificates for each jack-and-gage pair on Project site that are available for inspection. Exercise care in handling stressing equipment to ensure that proper calibration is maintained.
B. Stress tendons only under supervision of a qualified post-tensioning superintendent. Coordinate concrete strength required with requirements of post-tensioning supplier.
C. Do not begin stressing operations until concrete strength has reached 3750 psi as indicated by compression tests of field-cured cylinders or as indicated on structural drawings.
D. Complete stressing within 96 hours of concrete placement.
E. If concrete has not reached required strength, obtain Architect's approval to partially stress tendons and delay final stressing until concrete has reached required strength. Retain first paragraph below if stage stressing is required; revise to suit Project.
F. If de-tensioning and restressing of tendon is required, discard wedges used in original stressing and provide new wedges.
G. Mark and measure elongations according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons." Measure elongations to closest 1/8 inch .
H. Submit stressing records within one day of completion of stressing. If discrepancies between measured and calculated elongations exceed plus or minus 7 percent, resolve these discrepancies to satisfaction of Architect.
I. Prestressing will be considered acceptable if accurately measured gage pressures obtained in the field correspond to required stressing force and calculated and measured elongations agree within 7 percent.
J. If measured elongations deviate from calculated elongations by more than 7 percent, additional testing, restressing, strengthening, or replacing of affected elements may be required.

3.7 TENDON FINISHING

A. Do not cut strand tails or cover anchorages until stressing records have been reviewed and approved by Architect.
B. Cut strand tails as soon as possible after approval of elongations. Tendons shall be cut and pocket recesses grouted no more than 7 days after the tendons have been stressed. In

the event that tendon cutting is delayed by more than 7 days, the anchorages and exposed strand shall be protected to prevent any intrusion of moisture.

C. Install caps and sleeves on intermediate anchorages within one day of stressing.

D. Cut strand tails and install encapsulation caps on stressing-end anchorages in accordance with PT supplier's system requirements within one day of Architect's acceptance of elongations.

E. Patch stressing pockets within one day of cutting strand tail. Clean inside surface of pocket to remove laitance or post-tensioning coating before installing patch material. Finish patch material flush with adjacent concrete.

F. A capping report stating that all encapsulation caps have been adequately installed and pocket recesses grouted shall be submitted to Architect.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency and a qualified special inspector to perform special inspections, field tests and inspections and prepare test reports.

1. Before concrete placement, special inspector and testing agency will inspect the following for compliance with post-tensioning installation drawings and the Contract Documents:
   a. Location and number of tendons.
   b. Tendon profiles and covers.
   c. Installation of backup bars, hairpins, and other nonprestressed reinforcement shown on post-tensioning installation drawings.
   d. Installation of pocket formers and anchorage devices.
   e. Repair of damaged sheathing.
   f. Connections between sheathing and anchorage devices.
2. Testing agency will record tendon elongations during stressing and will immediately report deviations from the Contract Documents to Architect. Testing agency will immediately report deviations from the Contract Documents to Architect.
3. Testing agency shall submit capping report.

3.9 PROTECTION

A. Do not expose tendons to electric ground currents, welding sparks, or temperatures that would degrade components.

B. Protect exposed components within one workday of their exposure during installation.

C. Prevent water from entering tendons during installation and stressing.

D. Provide weather protection to stressing-end anchorages if strand tails are not cut within 10 days of stressing the tendons.

3.10 REPAIRS

A. Submit repair procedure to Architect for evaluation and approval.

B. Do not proceed with repairs requiring removal of concrete unless authorized in writing by Architect.

END OF SECTION

SECTION 035401

GYPSUM UNDERLAYMENT – Interior Use in Unit Areas to Receive Carpet

PART 1 GENERAL

1.1 SECTION INCLUDES
1. Lightweight gypsum underlayment over structural floor deck sheathing. ***Provide in units in those areas to receive carpet.***
2. NOTE: Refer to Section 35402 for gypsum underlayment to be installed under hard surface flooring in unit kitchen, bath and entry areas, and other elevated floor areas over units.

1.2 SUBMITTALS
1. Submit under provisions of Section 01330.
2. Product Data: Provide physical characteristics, thermal values, and product limitations for underlayment system and all accessories.
3. Manufacturer's Installation Instructions: Indicate product installation criteria, environmental and curing requirements, and recommendations for adhering floor coverings.
4. Design Mix: Indicating properties and proportions of each type of mix.
5. Certifications: Submit certification letter from manufacturer, co-signed by applicator, that materials used in the work comply with specified requirements.

1.3 QUALITY ASSURANCE
1. Installer: Trained by manufacturer and specializing in placing lightweight gypsum underlayment specified in this Section with minimum three years documented experience and approved by manufacturer.
2. Proportion, mix, install and finish, and cure gypsum underlayment in strict accordance with manufacturer's printed instructions.

1.4 REGULATORY REQUIREMENTS
1. Conform to applicable code for combustibility requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS
1. Accucrete as manufactured by Allied Custom Gypsum of Norman, OK
2. Firm-Fill and Firm-Fill High Strength as made by Hacker Industries, Newport Beach, CA.
3. Gyp Crete as made by Gypcrete Corp., Hamel, MN.
4. Level Rock, by US Gypsum.
5. Substitutions: Under provisions of Section 01600.

2.2 MATERIALS
1. Gypsum Underlayment: Gypsum based, cementitious mix.
2. Water: Drinkable and not detrimental to underlayment.
3. Primer and Sealer: Types as approved by manufacturer.
4. Joint and Crack Filler: Latex based.
5. Sand: Washed plaster or mortar sand, meeting manufacturer's approval.

2.3 MIX DESIGN
1. Prepare mix in accordance with manufacturer's recommendations and to develop the following characteristics:
a. Density: 100 lb/sq ft minimum dry density.
b. Compressive Strength: 2000 psi minimum) in accordance with ASTM C472.
c. Fire Hazard Classification: 0/0/0 (Flame/Fuel/Smoke) rating in accordance with ASTM E286.

2. Mix to consistency to achieve self-leveling.
3. Utilize only materials that are approved by the manufacturer.

2.4 EQUIPMENTS
1. Utilize mixing and pumping equipment approved by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION
1. Verify deck surface under provisions of Section 01320.
2. Verify that deck surface is suitable to receive work of this Section.
3. Do not begin installation until building is roofed and installation can be protected from weather.
4. Verify that structural floor is rigid, having a maximum deflection of L/360.
5. Confirm that work of this section will be complete and allowed to cure before gypsum board wall construction begins.

3.2 PREPARATION
1. Remove nubs, projections, irregularities, and other contaminates. Fill voids, deck joints and irregularities with filler. Finish smooth.
2. Prime wood substrate in accordance with manufacturer's recommendations. Allow to dry.

3.3 INSTALLATION
1. Place and finish lightweight gypsum underlayment and screed surface to achieve thickness as indicated on the drawings (1 1/4" minimum to match overall thickness of areas with sound mat).
2. Install under all bathtubs
3. Install between sill plates of all tenant separation walls.
4. Place in continuous operation, avoiding placement of material against areas which have already achieved initial set, except at authorized joints.
5. Spread and screed to a smooth surface.

3.4 CURING/PROTECTION
1. Air cure in accordance with manufacturer's instructions. Ventilate interior spaces as required.
2. Protect concrete from excess evaporation of surface moisture.
3. Wherever heavy wheeled traffic or concentrated loads will occur, provide temporary wood planking to distribute loads.

END OF SECTION

SECTION 03 54 02

GYPSUM CONCRETE UNDERLAYMENT
Interior Use in Unit Areas to receive Vinyl Tile/Ceramic Tile and other Hard Surface Flooring

PART 1 GENERAL

1.1 SECTION INCLUDES

1. Lightweight gypsum underlayment over Sound Matt installed on structural floor deck sheathing. Provide in units in those areas to receive vinyl tile and ceramic tile. Provide also in all public and common areas throughout the structure and in all corridors and lobbies.
2. NOTE: Refer to Section 035401for gypsum underlayment to be installed in unit areas to receive carpeting.

1.2 SUBMITTALS

1. Submit under provisions of Section 013330.
2. Product Data: Provide physical characteristics, thermal values, and product limitations for underlayment system and all accessories.
3. Manufacturer's Installation Instructions: Indicate product installation criteria, environmental and curing requirements, and recommendations for adhering floor coverings.
4. Design Mix: Indicating properties and proportions of each type of mix.
5. Certifications: Submit certification letter from manufacturer, co-signed by applicator, that materials used in the work comply with specified requirements.

1.3 QUALITY ASSURANCE

1. Installer: Trained by manufacturer and specializing in placing lightweight gypsum underlayment specified in this Section with minimum three years documented experience and approved by manufacturer.
2. Proportion, mix, install and finish, and cure gypsum underlayment in strict accordance with manufacturer's printed instructions.

1.4 REGULATORY REQUIREMENTS

1. Conform to applicable code for combustibility requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1. Accucrete as made by Allied Custom Gypsum, Norman, OK
2. Firm-Fill High Strength as made by Hacker Industries, Newport Beach, CA.
3. Gyp Crete Dura Cap, made by Gypcrete Corp., Hamel, MN.
4. Substitutions: Under provisions of Section 016001.

2.2 MATERIALS

1. Sound Mat Underlayment: (Acoustimat II, USG SAM-N40 or Enkasonic)
2. 1” min Gypsum Underlayment – 2500 PSI
3. Gypsum based, cementitious mix.
4. Water: Drinkable and not detrimental to underlayment.
5. Primer and Sealer: Types as approved by manufacturer.
6. Joint and Crack Filler: Latex based.
7. Sand: Sand Aggregate shall be 1/8 inch (3 mm) or less, washed masonry or plaster sand, meeting requirements of Gypsum Underlayment MFR.

2.3 MIX DESIGN

1. Prepare mix in accordance with manufacturer's recommendations and to develop the following characteristics:

a. Density: 115 lb/sq ft minimum dry density.
b. Compressive Strength: 2000 PSI minimum) in accordance with ASTM C472.
c. Fire Hazard Classification: 0/0/0 (Flame/Fuel/Smoke) rating in accordance with ASTM E286.

2. Mix to consistency to achieve self-leveling.
3. Utilize only materials that are approved by the manufacturer.

2.4 EQUIPMENT
1. Utilize mixing and pumping equipment approved by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION
1. Verify that deck surface is suitable to receive work of this Section.
2. Do not begin installation until building is roofed and installation can be protected from weather.
3. Verify that structural floor is rigid, having a maximum deflection of L/360.
4. Confirm that work of this section will be complete and allowed to cure before gypsum board wall construction begins.

3.2 PREPARATION
1. Remove nubs, projections, irregularities, and other contaminates. Fill voids, deck joints and irregularities with filler. Finish smooth.
2. Prime wood substrate in accordance with manufacturer's recommendations. Allow to dry.

3.3 INSTALLATION
1. Install sound mat per manufacturer’s instructions.
2. Place and finish lightweight gypsum underlayment and screed surface to achieve thickness as indicated on the drawings (1" minimum over Sound Mat 1 ¼” overall Thickness).
3. Install UNDER ALL TUBS prior to tub installation
4. Install between sill plates of all tenant separation walls.
5. Place in continuous operation, avoiding placement of material against areas which have already achieved initial set, except at authorized joints.
6. Spread and screed to a smooth surface.

3.4 CURING/PROTECTION
1. Air cure in accordance with manufacturer's instructions. Ventilate interior spaces as required.
2. Protect concrete from excess evaporation of surface moisture.
3. Wherever heavy wheeled traffic or concentrated loads will occur, provide temporary wood planking to distribute loads.

END OF SECTION

SECTION 04 00 00

MASONRY

Division 3 and Structural Engineer govern this Section.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete blocks, mortar, and accessories for concrete unit masonry construction.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General Conditions, Supplementary Conditions, and Division 1 Section apply to this section.

1.03 REFERENCES

A. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM C90 - Hollow Load Bearing Concrete Masonry Units.

C. ASTM C129 - Hollow Non-Load Bearing Concrete Masonry Units.

D. ASTM C144 - Aggregate for Masonry Mortar.

E. ASTM C150 - Portland Cement.

F. ASTM C198 - Cold Bonding Strength of Refractory Mortar.

G. ASTM C207 - Hydrated Lime for Masonry purposes.

H. ASTM C270 - Mortar for Unit Masonry.

I. ASTM C476 - Grout for Masonry.

J. IMIAC - International Masonry Industry All-Weather Council -Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.04 SUBMITTAL

A. Submit under provisions of Section 01300, minimum 30 days prior to start of scheduled installations.

1.05 DELIVERY. STORAGE AND HANDLING

A. Deliver, store and protect products under provisions of Section 01600.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete Masonry Units:
   1. Manufacturers: TXI, Featherlite, Eagle Lake, Park Brothers, Lufkin Block Co., Cordell Brick Co., Revels Block & Brick Co., or equal. Use same manufacturer throughout the Project.
   2. Types
      a. Typical Lightweight Units – Hollow load bearing type complying with ASTM C-90, Grade N, Type 1, moisture controlled unit, lightweight aggregate per ASTM C-331 for a dry net weight of not more than 105 lbs. per cubic foot, autoclave process. Typical lightweight units shall be used throughout the work except where rated units are required or other types of units are indicated on the drawings.
      b. Fire Rated – Provide rated units where rated walls are indicated. Rated units shall meet requirements of Underwriters Laboratories and Arapahoe County, Colorado. Provide certificate from independent testing lab certifying that the units meet required fire rating.
   3. Shapes: Provide special shapes where indicated on the drawings.
   4. Sizes: 7-5/8" high by 15-5/8" long by depths as indicated on the drawings.
   5. Finish: Uniformly textured with no slick spots or lacy edges.

C. Mortar:
   1. Portland Cement: ASTM C 150, Type I, Gray.
   2. Mortar Aggregate: ASTM C144, Standard Masonry Type.
   3. Masonry Cement: ASTM C270 Type `N'.
   4. Water: Clean and Potable.

D. Reinforcement and Anchorage:
   1. Concrete Masonry Unit Reinforcing: ASTM A153, truss type, width 1 inch less than nominal wall thickness. Configurations as required. Refer to Structural Drawings.

2.02 MORTAR MIXES

A. Mortar: ASTM C270 "Proportion Specifications," Type N or S. 1800 psi at 28 day compressive strength.

B. Grout: ASTM C476, 3000 psi at 28 day compressive strength.

C. Mixing:
1. Mix mortar ingredients in accordance with ASTM C270.
2. Do not use anti-freeze compounds to lower the freezing point of mortar.
3. If water is lost by evaporation, re-temper only within two hours of mixing.
4. Use mortar within two hour after mixing at temperatures of 80 degrees F, or two-and-one-half-hours at temperature under 50 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field conditions are acceptable and ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

C. Verify built-in items are in proper locations, and ready for roughing into masonry work.

D. Beginning installation means acceptance of existing conditions.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Verify concrete masonry units are dry prior to laying.

3.03 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimensions. Form vertical and horizontal joints uniform thickness.

C. Lay concrete masonry units with face shell bedding on head and bed joints.

D. Remove excess mortar as Work progresses.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Flush Joints: Use where joints are concealed.

G. Joining Work: Remove loose mortar when joining fresh masonry to partially set masonry.

H. Reinforcement: Install at 16" vertically, to anchor to adjacent framing.

3 .04 CLEANING

A. Clean work under provisions of Section 01700.

B. Remove excess mortar and mortar smears.

C. Replace defective mortar. Match adjacent work.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Section 01500.

END OF SECTION

SECTION 04 00 00

MASONRY

Division 3 and Structural Engineer govern this Section.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete blocks, mortar, and accessories for concrete unit masonry construction.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General Conditions, Supplementary Conditions, and Division 1 Section apply to this section.

1.03 REFERENCES

A. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM C90 - Hollow Load Bearing Concrete Masonry Units.

C. ASTM C129 - Hollow Non-Load Bearing Concrete Masonry Units.

D. ASTM C144 - Aggregate for Masonry Mortar.

E. ASTM C150 - Portland Cement.

F. ASTM C198 - Cold Bonding Strength of Refractory Mortar.

G. ASTM C207 - Hydrated Lime for Masonry purposes.

H. ASTM C270 - Mortar for Unit Masonry.

I. ASTM C476 - Grout for Masonry.

J. IMIAC - International Masonry Industry All-Weather Council -Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.04 SUBMITTAL

A. Submit under provisions of Section 01300, minimum 30 days prior to start of scheduled installations.

1.05 DELIVERY. STORAGE AND HANDLING

A. Deliver, store and protect products under provisions of Section 01600.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete Masonry Units:
1. Manufacturers: TXI, Featherlite, Eagle Lake, Park Brothers, Lufkin Block Co., Cordell Brick Co., Revels Block & Brick Co., or equal. Use same manufacturer throughout the Project.
2. Types
a. Typical Lightweight Units – Hollow load bearing type complying with ASTM C-90, Grade N, Type 1, moisture controlled unit, lightweight aggregate per ASTM C-331 for a dry net weight of not more than 105 lbs. per cubic foot, autoclave process. Typical lightweight units shall be used throughout the work except where rated units are required or other types of units are indicated on the drawings.
b. Fire Rated – Provide rated units where rated walls are indicated. Rated units shall meet requirements of Underwriters Laboratories and Arapahoe County, Colorado. Provide certificate from independent testing lab certifying that the units meet required fire rating.
3. Shapes: Provide special shapes where indicated on the drawings.
4. Sizes: 7-5/8” high by 15-5/8” long by depths as indicated on the drawings.
5. Finish: Uniformly textured with no slick spots or lacy edges.

C. Mortar:
1. Portland Cement: ASTM C 150, Type I, Gray.
2. Mortar Aggregate: ASTM C144, Standard Masonry Type.
3. Masonry Cement: ASTM C270 Type `N'.
4. Water: Clean and Potable.

D. Reinforcement and Anchorage:
1. Concrete Masonry Unit Reinforcing: ASTM A153, truss type, width 1 inch less than nominal wall thickness. Configurations as required. Refer to Structural Drawings.

2.02 MORTAR MIXES

A. Mortar: ASTM C270 "Proportion Specifications," Type N or S. 1800 psi at 28 day compressive strength.

B. Grout: ASTM C476, 3000 psi at 28 day compressive strength.

C. Mixing:
1. Mix mortar ingredients in accordance with ASTM C270.
2. Do not use anti-freeze compounds to lower the freezing point of mortar.
3. If water is lost by evaporation, re-temper only within two hours of mixing.
4. Use mortar within two hour after mixing at temperatures of 80 degrees F, or two-and-one-half-hours at temperature under 50 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field conditions are acceptable and ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

C. Verify built-in items are in proper locations, and ready for roughing into masonry work.

D. Beginning installation means acceptance of existing conditions.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Verify concrete masonry units are dry prior to laying.

3.03 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimensions. Form vertical and horizontal joints uniform thickness.

C. Lay concrete masonry units with face shell bedding on head and bed joints.

D. Remove excess mortar as Work progresses.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Flush Joints: Use where joints are concealed.

G. Joining Work: Remove loose mortar when joining fresh masonry to partially set masonry.

H. Reinforcement: Install at 16" vertically, to anchor to adjacent framing.

3 .04 CLEANING

A. Clean work under provisions of Section 01700.

B. Remove excess mortar and mortar smears.

C. Replace defective mortar. Match adjacent work.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Section 01500.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Unit masonry assemblies as follows:
   1. Concrete masonry units.
   2. Brick veneer.
   3. Mortar and grout.
   4. Reinforcing steel.
   5. Masonry joint reinforcement.
   6. Ties and anchors.
   7. Embedded flashing.
   8. Miscellaneous masonry accessories.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data for each different masonry unit, accessory and other manufactured product specified including unit strength.

B. Shop Drawings:
   9. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. Samples:
   10. Masonry and Brick Units: Submit two full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   11. Each type of masonry unit required.
      a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
   12. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
   13. Each material and grade indicated for reinforcing bars.
   14. Each type and size of joint reinforcement.
   15. Each type and size of anchor, tie, and metal accessory.

1.3 QUALITY ASSURANCE

A. Source Limitations
   16. Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
   17. Mortar Materials: Obtain mortar ingredients of a uniform quality, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

B. Standards:
   18. Comply with the requirements of ACI 530.1/ASCE 6 "Specifications for Masonry Structures", except as otherwise indicated.

C. Regulatory Requirements:
   19. Masonry materials and workmanship shall meet requirements of building codes which are applicable to jurisdiction in which Project is located.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle masonry units in such a manner as to prevent chipping and breakage.

B. Store masonry units on elevated platforms in a dry location.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

G. Replace damaged material at no cost to Owner.

1.5 PROJECT CONDITIONS

A. Cold-Weather Requirements:
   20. Protect masonry units from freezing weather and prevent accumulation of ice.
   21. Do not build on frozen substrates.
   22. Remove and replace unit masonry damaged by frost or by freezing conditions.
   23. Do not lay concrete masonry units when temperature of surrounding atmosphere is below 40 degrees F or is likely to fall below 40 degrees F in the 24 hour period after laying, unless adequate protection is provided.
   24. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

B. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
   25. When ambient temperature exceeds 100 degrees F, or 90 degrees F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

1.6 SCHEDULING

A. Coordination: Coordinate with other trades whose Work relates to concrete masonry unit installation for placing required blocking, backing, furring, conduits and other items.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General:
   26. Concrete masonry units shall meet ASTM C90 requirements, except as follows:
      a. Exposed Units – Finish and Appearance: Modify ASTM C90 paragraph regarding percentage of shipment containing chips to read: "Three percent of a shipment containing chips not larger than 1/2 inch in any dimension, or cracks not wider than 0.02 inches and not longer than 10 percent of the nominal height of the unit is permitted."
   27. Units shall be in the same condition in wall as they were upon delivery.
   28. Units not complying with the appropriate ASTM standards shall not be used. Any unit that is chipped in excess of the requirements will be rejected and shall be removed and replaced.
   29. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

B. Concrete Masonry Units:
   30. Unit Compressive Strength: As indicated on General Structural Notes or Drawings.
   31. Weight Classification: Medium weight or normal weight in accordance with ASTM C90, unless otherwise indicated.
   32. Sizes: As indicated on Drawings.
   33. Exposed Faces:
      a. Smooth Face: Manufacturer's standard color and texture, unless otherwise indicated.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type II, Type V shall be used at locations in contact with soil. Provide natural color as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C150, Type I or Type III, and hydrated lime complying with ASTM C207.

D. Aggregate:
   34. Mortar: ASTM C144; Clean, sharp and well graded and free from injurious amounts of dust, lumps, shale, alkali, surface coatings and organic matter, conforming to ASTM C144, except that no less than 3 percent nor more than 10 percent shall pass a No. 100 sieve except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   35. Grout: ASTM C404.

E. Water: Potable.

F. Color: Mineral oxide pigment. To be selected by Architect.

2.3 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A615; ASTM A616, including Supplement 1; or ASTM A617, Grade 60.

2.4 MASONRY JOINT REINFORCEMENT

A. General: ASTM A951 and as follows:

36. Single-wythe masonry: Ladder type with single pair of side rods and cross rods spaced not more than 16 inches on center.
37. Material: Hot-dip galvanized, carbon-steel wire.
38. Wire Size for Rods:
    a. 1/4 inch to 3/8 inch joints: W1.7 or 0.148-inch diameter.
    b. 1/2 inch joints: W2.8 or 0.188-inch diameter.
39. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.

2.5 TIES AND ANCHORS

A. Materials, General: As follows, unless otherwise indicated:
40. Galvanized Steel Sheet: ASTM A366 cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A153, at exterior walls; and ASTM A653, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication at interior walls.

B. Bent Wire Ties: Rectangular units with closed ends and not less than 4 inches wide, made from 3/16-inch-diameter, galvanized steel wire.

C. Adjustable Masonry-Veneer Anchors: Provide 2-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to wall, for attachment over sheathing to wood or metal studs, and that are capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

D. Framing Anchors:
41. 3/16 inch diameter steel wire of approved shape, machine fabricated, designed to be screw fastened.
42. Provide 2-piece "Rectangular" or "Triangular" strut, compression and tension, eye and pin tie.
43. Screws shall have a copolymer corrosion resistant coating or be Type 304 stainless steel, suitable for attachment of veneer anchors, length as required.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Fabricate from the following metal complying with requirements specified in Section 07 62 00 - Sheet Metal Flashing and Trim and in accordance with NCMA TEK 19-2A, 19-4A and 19-5A and as follows:
44. Stainless Steel: 0.0156 inch thick.
45. Fabricate through-wall metal flashing embedded in masonry from sheet metal indicated above and with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
46. Fabricate metal expansion-joint strips from sheet metal indicated above, formed to shape indicated.
47. Fabricate metal drip edges from sheet metal indicated above. Extend at least 3 inches into wall and 1/2 inch out from wall, with a hemmed outer edge bent down 30 degrees.

B. Concealed Flashing: Rubberized-asphalt flashing, manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.040 inch (40 mil).
48. Acceptable Products:
    a. Textroflash; Hohmann & Barnard.
    b. Perm-A-Barrier Wall Flashing; W. R. Grace & Co., Construction Products Division.
    c. Polyguard 400 Flashing; Polyguard Products, Inc.
49. Provide metal drip caps for flashing edges brought to exterior of wall.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.

D. Weather Resistive Barrier: Provide one of the following as approved by Architect and as accepted by code:
   50. Asphalt-saturated felt, ASTM D226, Type II, No. 30, nonperforated.
   51. Asphalt-impregnated paper factory-bonded to back of lathing and complying with FS UU-B-790, for Type I, Grade D (Vapor Permeable), Style 2.

2.7 MASONRY ACCESSORIES

A. Underlayment: As specified in Section 07 25 00 - Building Wrap.

B. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

C. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
   52. Styrene-Butadiene-Rubber Compound: ASTM D2000, Designation M2AA-805.
   53. PVC: ASTM D2287, Type PVC-65406.

D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

E. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.

F. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

G. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.
   54. Provide units with either two loops or four loops as needed for number of bars indicated.

2.8 MORTAR AND GROUT MIXES

A. General: Use only those admixtures indicated.
   55. Do not use calcium chloride in mortar or grout.
   56. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
   57. For masonry below grade, in contact with earth, and where indicated: Type M.
   58. Other Locations: Type S.

D. Grout for Unit Masonry: Comply with ASTM C476.
   59. Job-Site Mixed: In accordance with ASTM C476.

60. Transit-Mixed:
    a. Designed by the supplier or an independent testing laboratory with a minimum compressive strength as indicated in the General Structural Drawings and Notes.
    b. Slump: Not to exceed 8 inches, as measured according to ASTM C143, unless otherwise noted on Drawings.
    c. Use within 1-1/2 hours of initial mixing and do not use grout after it has begun to set or after it has become harsh or non-plastic.

E. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's directions.

2.9 SOURCE QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
    61. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with installer present for compliance with requirements for installation tolerances and other conditions affecting performance. Notify Contractor, in writing, conditions detrimental to proper and timely completion of Work. Do not proceed with the installation of unit masonry Work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
    62. Verify that foundations are within tolerances specified.
    63. Verify that reinforcing dowels are properly placed.
    64. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 PROTECTION

A. Protection of Masonry: During construction, 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.
    65. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. 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.
    66. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
    67. Protect sills, ledges, and projections from mortar droppings.
    68. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

69. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

3.3 INSTALLATION - GENERAL

A. General:
70. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
71. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
72. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. 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.
73. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

3.4 ERECTION

A. Workmanship: Concrete masonry units which will be exposed in the finished work shall be treated as an architectural finish and shall be handled carefully to ensure that chippages do not occur during handling and laying. Handling shall be minimized on the jobsite to eliminate chances for chippage.

B. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

C. Bond Pattern: One-half running bond with vertical joint in each course centered on units in courses above and below. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-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 before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
74. Install compressible filler in joint between top of partition and underside of structure above.

75. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:
   76. With full mortar coverage on horizontal and vertical face shells.
   77. 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.
   78. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 CAVITY WALLS

A. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   79. Space reinforcement not more than 16 inches on center.
   80. Space reinforcement not more than 8 inches on center in foundation walls and parapet walls.
   81. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
      a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY VENEERS

A. Underlayment: Install in accordance with Section 07 25 00 - Building Wrap.

B. Anchor masonry veneers to substrate with masonry-veneer anchors to comply with the following requirements:
   82. Fasten each anchor section through sheathing to framing with metal fasteners of type indicated in accordance with anchor manufacturer's instructions and code requirements.
   83. Embed tie sections in masonry joints.
   84. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

85. Space anchors as indicated and as required by code, but not more than 24 inches on center horizontally, with not less than 1 anchor for each 2 square feet of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around the perimeter.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
86. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
87. Install preformed control-joint gaskets designed to fit standard sash block.
88. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
89. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.
90. Control joint materials shall be held back from finished surface as required to allow for sealant and back-up materials.

C. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 - Joint Sealants.
91. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.10 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

C. Install flashing as follows:
92. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of interior substrate at least 8 inches, and behind underlayment.
93. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing 4 inches at ends and turn flashing up not less than 2 inches to form a pan.
94. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a drip.
95. Flexible Flashing: Install metal drip edges beneath flashing at exterior face of wall. Stop flashing 1/2 inch back from outside face of wall and adhere flashing to top of metal drip edge.

D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
96. Space weep holes 16 inches on center.
97. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

E. Place cavity drainage material immediately above flashing in cavities.

F. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 and General Structural Notes or Drawings.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

98. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 and General Structural Notes or Drawings for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.12 CONSTRUCTION TOLERANCES

A. Comply with the following tolerances:

99. Standard and Economy Level of Quality (locations not exposed to Public view in final construction):
    a. External corners and other conspicuous lines and levels: +/- 1/2 inch in any 10'-0" section.
    b. Line of sealant filled movement joints (allowable deviation from specified or indicated): +/- 1/2 inch in any 10'-0" section.
    c. Actual cross sectional dimension of columns and walls (allowable deviation from specified or indicated): - 3/8 inch, + 3/4 inch.
    d. Adjacent unit faces in plane (allowable deviation from specified or indicated): +/- 3/16 inch.
    e. Mortar bed joint thickness (allowable deviation from specified or indicated): -1/8 inch, + 1/4 inch.
    f. Mortar head joint thickness (allowable deviation from specified or indicated): - 1/4 inch, + 3/8 inch.
    g. Vertical alignment of the centerline of corresponding head joints in alternate courses when using other than stack bond (allowable deviation from specified or indicated): +/- 5/8 inch.
    h. Vertical alignment of the centerline of all head joints in a total wall height not to exceed 30'-0" when using other than stack bond (allowable deviation from specified or indicated): +/- 2 inches.
    i. Vertical alignment of the centerline of all head joints in total wall height not to exceed 30'-0" when using stack bond: (allowable deviation from specified or indicated): +/- 1 inch.
100. Custom Level of Quality (exposed brick locations):
    a. External corners and other conspicuous lines and levels: +/- 1/4 inch in any 10'-0" section.
    b. Line of sealant filled movement joints (allowable deviation from specified or indicated): +/- 3/8 inch in any 10'-0" section.
    c. Actual cross sectional dimension of columns and walls (allowable deviation from specified or indicated): - 1/4 inch, + 1/2 inch.
    d. Adjacent unit faces in plane (allowable deviation from specified or indicated): +/- 1/8 inch.
    e. Mortar bed joint thickness (allowable deviation from specified or indicated): - 1/8 inch, + 1/8 inch.
    f. Mortar head joint thickness (allowable deviation from specified or indicated): - 1/8 inch, + 1/4 inch.
    g. Vertical alignment of the centerline of corresponding head joints in alternate courses when using other than stack bond (allowable deviation from specified or indicated): +/- 3/8 inch.
    h. Vertical alignment of the centerline of all head joints in a total wall height not to exceed 30'-0" when using other than stack bond (allowable deviation from specified or indicated): +/- 1 inch.
    i. Vertical alignment of the centerline of all head joints in total wall height not to exceed 30'-0" when using stack bond: (allowable deviation from specified or indicated): +/- 1/2 inch.

3.13 FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below.
   101. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and evaluations listed in this Article will be performed during construction for each 5000 square feet of wall area or portion thereof.

C. Mortar properties will be tested in accordance with ASTM C780.

D. Grout will be sampled and tested for compressive strength in accordance with ASTM C1019.

E. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C140.

3.14 REPAIRING, POINTING, AND MASONRY CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, 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 sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: As specified in Section 04 01 20.52 – Masonry Cleaning.

3.15 CLEANING

A. Remove scaffolding and equipment used in Work.

B. Clean up debris, refuse and surplus material and remove from premises.

3.16 PROTECTION

A. Furnish temporary protection for exposed masonry corners subject to injury.

B. Carefully cover tops of walls left incomplete at conclusion of day's Work with tarpaulins or other approved covering.

C. In hot and dry weather, protect masonry against too rapid drying.

D. Protect finished Work against freezing for a period of not less than 48 hours by means of enclosures, artificial heat, or such other protective methods as may be required.

END OF SECTION

SECTION 05 12 13

ARCHITECHURALLY-EXPOSED STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The work of this Section consists of furnishing and erecting all structural steel work and Architecturally Exposed Structural Steel work (AESS) as shown on the Drawings and as specified herein and includes, but is not limited to, the following:

1. Leveling plates and anchor bolts.
2. Columns with base plates and connections.
3. Beams with connections.
4. Channels, angles, plates, frames, anchors, etc.
5. Moment connections.
6. Steel bracing with connections.
7. Shop paint and field touch-up paint after erection.
8. Galvanizing.
9. As-Built column and base plate surveys.

All structural steel that is exposed in the finish work shall be Architecturally Exposed Structural Steel work (AESS). Coordinate locations of all AESS with Architectural Drawings.

B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:

1. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Anchor bolts, embedded shapes with bolts or anchors, as indicated on the Drawings.

1.2 RELATED SECTIONS

A. Related work shall be performed under the following Sections:

1. Section 03 30 00 CAST-IN-PLACE CONCRETE.
2. Section 05 50 00 METAL FABRICATIONS.
3. Section 07 84 00 FIRESTOPPING.
4. Section 09 90 00 PAINTING AND COATING.

1.3 REFERENCES (LATEST EDITIONS)

A. "Code of Standard Practice for Steel Buildings and Bridges" and "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings" by the American Institute of Steel Construction.

B. The second sentence in paragraph 4.2.1 of the "Code of Standard Practice for Steel Buildings and Bridges" is deleted under the provisions of this Specification.

C. The “Seismic Provisions for Structural Steel Buildings” by the American Institute of Steel Construction, Inc.

D. The “Connections Manual of Steel Construction” by the American Institute of Steel Construction, Inc.

E. "Structural Welding Code - Steel" by the American Welding Society.

F. ASTM listed standards by the American Society for Testing and Materials.

G. SSPC listed standards by the Steel Structures Painting Council.

H. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.

I. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.4 SUBMITTALS

A. Before starting the work of the Shop and Erection Drawings, the steel fabricator shall have their representatives contact the Architect and arrange to meet with or call the Architect and Structural Engineer to discuss connection details, schedules, shop procedures, materials, and other concerns related to structural steel work.

B. Prior to preparation of Shop Drawings, the fabricator shall submit typical details of all structural steel and Architecturally Exposed Structural Steel connection types including, but not limited to, moment connections, beam to column and beam to girder connections, arch connections, column splices, beam splices, bracing and hanger details, etc., for approval by the Architect and Structural Engineer. Design of all connections is to be provided by the fabricator, under the supervision of a registered, professional structural engineer, registered in the state that the project is located in.

C. Prior to submission of Shop Drawings, Contractor shall verify all dimensions, site conditions, etc., relating to existing conditions. Any discrepancies which affect the structural design or details shall be brought to the attention of the Architect and Structural Engineer.

D. No variance from design sizes and details will be permitted on submitted Shop Drawings, but requests for modification of connection type or details to better suit their shop practice, or for any other reasons, will be considered by the Architect and Structural Engineer.

E. Shop Drawings shall include all information required for fabrication of the component parts of the structure. Erection drawings shall clearly indicate all AESS members. They shall indicate size and weight of members, surface preparation, type and location of shop and field connections, the type, size and extent of all welds. Identify grinding, finish and profile of welds. The welding symbols used on the Shop Drawings shall be as adopted by the American Welding Society. Identify type, size finish and length of bolts, distinguishing between shop and field bolts. Indicate direction of bolt head orientation at connections for all AESS members.

F. Approval of Shop Drawings shall be for size and arrangement of principal and auxiliary members and for strength of connections. Any errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.

F. Fabrication of any material or performing of any work prior to the final approval of the Shop Drawings will be entirely at the risk of the Contractor.

H. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the following conditions:

1. The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from United Structural Consultants, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.

2. The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.

3. The User further agrees to release, indemnify, hold harmless and defend United Structural Consultants, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or relate to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

I. Reports: Submit certified copies of mill test reports for all structural steel furnished.

1.5 MOCKUPS

A. At least four (4) weeks prior to fabricating AESS, the fabricator shall construct mockups to demonstrate aesthetic effects as well as the qualities of the materials and workmanship. Mockups of details shall include a representation of each type of exposed connection or built up member.

B. Build mockups on site for review and approval by Architect. Mockups shall be full-size pieces, unless smaller models are approved by the Architect. Mockups may be part of the completed structure, as approved by the Architect.

1. Obtain Architect's approval of mockups prior to fabrication of final units.

2. Mockups shall have a finished surface, including surface preparation and paint/fire protection system.

C. Retain and maintain mockups during construction in an undisturbed condition, as a standard for judging the completed AESS work.

1.6 QUALITY ASSURANCE

A. Qualifications: The steel fabricator conducting the work of this Section shall be AISC certified and experienced in fabricating AESS similar to that required for this project.

B. All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Architect, or by qualified inspectors selected by the Architect and paid directly by the Owner.

C. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.

D. Inspection of welding work other than moment connections shall consist of non-destructive spot testing done by visual, magnetic particle, radiographic or ultrasonic methods, whichever is most effective for joint to be tested.

E. Inspection of welding for work for moment connections shall be tested one hundred (100) percent either by ultrasonic or by radiography in accordance with the latest edition of the AWS Structural Welding Code. However, if, for an individual welder, the reject rate is demonstrated to be five (5) percent or less, the non-destructive testing rate may be reduced to twenty-five (25) percent for the individual welder. The evaluation of the welding shall be based on a sampling of at least forty (40) completed welds.

F. Inspection of bolting work shall be in accordance with "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" by the American Institute of Steel Construction, latest edition. All bolting shall be visually inspected as directed by the Architect and Structural Engineer.

G. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities as required for this inspection.

H. A final report shall be issued by the testing agency following the completion of work in this Section stating that all deficiencies have been corrected.

1.7 SUBSTITUTIONS

A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the following conditions:

1. That request has been made and accepted prior to submission of Shop Drawings.

2. That there is a substantial cost advantage or time advantage to the Owner.

3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect, including cost reductions or savings in time to complete work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural steel shapes shall comply with the requirements of ASTM A 992 or A 588 - Grade B (50 ksi) for Structural Steel. Structural steel plates shall comply with ASTM A 36. Steel tubing shall comply with ASTM A 500 Grade B. Steel pipe shall comply with ASTM A 53 Grade B.

B. Bolts, nuts and washers shall comply with the requirements of ASTM A 325. Bolts shall be A 325N with washer.

C. Anchor rods shall comply with the requirements of ASTM F 1554 – Grade 36, except F 1554 – Grade 105 as indicated on the Drawings. All anchor rods shall be headed type, with washer.

D. Expansion bolts shall be Hilti Kwik Bolt II Expansion Anchors or an approved equal.

E. Epoxy injection anchor bolts shall be Hilti HIT Adhesive Anchors or an approved equal.

F. Metallic Filler: Composition of 90% ground metal and 10% epoxy binder as manufactured by Devcon Corporation.

2.2 FABRICATION

A. All structural steel shall be fabricated in accordance with References, approved Shop Drawings, and as hereinafter specified.

B. All structural steel to remain exposed to view shall be fabricated in accordance with Chapter 10, Architecturally Exposed Structural Steel (AESS), in the AISC manual, unless more stringent requirements are specified herein. Continuously weld joints in AESS members. The welds shall be ground or otherwise treated as required to blend with adjacent parent metal. In addition, fabricate as follows:

1. Fabricate AESS with exposed surfaces smooth, square and of surface quality with the approved mockups. Use special care in handling and shipping AESS before and after shop painting.
2. Fabricator shall grind welds of AESS smooth. For groove welds, the welds shall be made flush to the surfaces each side and be within +1/16" and –0" of plate thickness.
3. Remove spatter and grind where necessary for blending. Contour surfaces to match those surfaces that are adjacent. Form fillets to the smallest radii possible and still comply with the structural requirements. Provide additional metallic filler to form smooth continuous surfaces that will appear as one piece construction when primed. Grind and polish as required, to match profile on approved mockup.
4. Where continuous welding is noted on the Drawings, provide uniform size and profile. All exposed welds shall be continuous, unless otherwise noted on the Drawings.
5. Fabricate AESS members such that piece marks are fully hidden in the final structure or use media to permit full removal.
6. Members specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem and of outstanding flanges of open sections shall be visibly acceptable to the Architect from a distance of 20 feet under any lighting condition.
7. Seal weld open ends of rectangular hollow structural sections with 3/8" minimum closure plates.

C. The design of members and connections for any portions of the structure not indicated on the Drawings shall be completed by the fabricator. Unless otherwise noted on the drawings, connections shall be capable of supporting the maximum uniform load of the member for the span shown and the material specified. Consideration must be given to the additional load carrying capacity of composite steel members. In general, and unless otherwise indicated, connections for composite beams shall be designed for at least 1.75 times the end reaction derived from the AISC uniform load beam tables for the particular beam and span. Connections for girders which support other beams should be designed for at least 1.5 times the AISC uniform load reaction. All connection design shall be subject to approval by the Architect and Structural Engineer.

D. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.

E. All shop connections shall be welded or bolted.

F. Weld and joint details shall comply with requirements of the "Structural Welding Code - Steel" by the American Welding Society.

G. Bolting shall comply with the requirements of AISC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

H. All field connections shall be bolted, except where welding is indicated on the Drawings. All field bolts shall be alternate design type with twist off elements.

I. Diameter of holes in bolted parts shall be 1/16" greater than the nominal diameter of the bolt. No unfair holes will be accepted, and enlargement of holes shall not be accomplished by burning. Burrs resulting from drilling or punching shall be ground to the surface of the material. Shearing and punching shall be done cleanly so as not to deform or mar adjacent surfaces.

J. Provide holes and connections as required for site assembly of steel work. Holes shall be drilled or punched and reamed in the shop. Show sizes and locations of all such holes on the Shop Drawings.

K. Provide angles, bars, etc. as necessary for deck support at columns where members do not frame in from all four sides and where connections interfere with the support of metal decking.

L. Provide angles, channels, etc. around all openings in roof deck at drains, fans, etc. as shown in drawings. Coordinate size, number, and location with architectural, mechanical, electrical, and plumbing trades.

M. In general, beam to beam, and beam to column connections shall be double angle type connections, unless otherwise shown on the Drawings.

2.3 SURFACE PREPARATION AND PROTECTIVE COATINGS

A. All structural steel shall be cleaned of all scale, rust, grease and other foreign matter.

B. Surface preparation for interior not exposed to view structural steel shall be in accordance with “Steel Structures Painting Council Surface Preparation No. 3, Power Tool Cleaning.”

C. Surface preparation for interior exposed to view structural steel and all exterior structural steel shall be in accordance with “Steel Structures Painting Council Surface Preparation No. 6, Commercial Blast Cleaning”.

D. Shop prime all steel members as specified herein, except the following:
1. Surfaces embedded in concrete.
2. Surfaces to be field welded.
3. The tops of steel beams where deck is to be welded.
4. Surfaces to be fireproofed.

E. Primer for interior structural steel, not exposed to view shall be as specified in Section 09900 or equivalent as approved by the Owner.

F. Primer for exterior structural steel, exposed to view and not scheduled to be fireproofed shall be in accordance to Section 09900 Painting, or equivalent as approved by Owner.

G. Primer shall be applied in accordance with manufacturer's instruction to provide a minimum dry film thickness of 1.5 mils at non-exposed areas and 3.0 to 3.5 mils at exposed areas. Use priming methods that result in full coverage of joints, corners, edges and exposed surfaces.

H. Shop and field touch-up paint shall be compatible with paint to be used for finish painting in the field as required under PAINTING and FIREPROOFING Sections.

I. Primer paint shall be applied in accordance with manufacturer's directions to ensure no running or sagging.

J. After erection, all scarred areas shall be touched up with the same paint as the shop coat.

2.4 GALVANIZING

A. All steel items noted on the Drawings to be galvanized shall be galvanized by the hot dip process conforming to ASTM A 123 with the addition of nickel to zinc bath. All galvanizing shall be done after fabrication. All galvanized material to be painted shall be primed by the galvanizer within twelve hours after galvanizing and shall be force cured in a facility capable of maintaining 150 degrees F. All hot dip galvanized steel shall be safeguarded against embrittlement according to ASTM A 143.

B. The galvanizer shall inspect all members for compliance with this Specification, and shall mark each member with a stamp indicating the ASTM number and the weight of the zinc coating in ounces per square foot.

2.5 FINISHING

A. Refer to Section 09 97 10, SPECIAL COATINGS FOR METAL.

PART 3 EXECUTION

3.1 STORAGE AND HANDLING

A. Care and protection shall be given to all structural steel during handling and storage. If items are to be stored prior to installation, they shall not be placed in contact with the ground. Care shall be taken to avoid abrasions and other damage.

3.2 ERECTION

A. All structural steel shall be anchored and erected in accordance with References, approved Shop Drawings, and as hereinafter specified.

B. All structural steel to remain exposed to view shall be erected in accordance with Chapter 10 Architecturally Exposed Structural Steel, in the AISC manual, unless more stringent requirements are specified herein.

1. Grind all field welds of AESS smooth. For groove welds, the welds shall be made flush to the surfaces each side and be within +1/16" and –0" of plate thickness.

2. Remove spatter and grind where necessary for blending. Contour surfaces to match those surfaces that are adjacent. Form fillets to the smallest radii possible and still comply with the structural requirements. Provide additional metallic filler to form smooth continuous surfaces that will appear as one-piece construction when primed. Grind and polish as required, to match profile on approved mockup.

3. Where continuous welding is noted on the Drawings, provide uniform size and profile. All exposed welds shall be continuous, unless otherwise noted on the Drawings.

4. Bolt heads shall be oriented as shown on the approved Shop Drawings.

5. Run-out tabs, angles, erection bolts and other steel members added to connections to allow for alignment, fit-up and welding in the field shall be removed from the structure. Remove backer bars, fill all "rat" holes and grind smooth at groove welded joints. Fill or plug weld holes for temporary erection bolts and grind smooth. All areas shall be touched up with the appropriate shop primer.

6. Splice members only as approved on the submitted Shop Drawings.

C. All work shall be accurately set to established lines and elevations and rigidly fastened in place with suitable attachments to the construction of the building.

D. Temporary bracing, guying, and support shall be provided to keep the structure safe and aligned at all times during construction, and to prevent danger to persons and property. Check all temporary loads and stay within safe capacity of all building components.

E. Except as otherwise indicated on the Drawings, all field connections shall be bolted in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts". All bolts shall be fully tensioned. Use not less than one (1) washer placed under the turning part of the assembly. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.

F. The initial installations of expansion bolts and epoxy injection anchor bolts, shall be witnessed by the manufacturers representative and load tests shall be performed to test their adequacy.

G. Do not cut or alter any member in the field without Architect's written approval for each specific condition.

H. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.

I. After erection, all structural steel members and connections shall be touched up with the appropriate primer.

J. Prior to field welding of any galvanized steel element, galvanizing in the general area to be welded must be removed by grinding.

K. All galvanized steel elements shall be touched up with a zinc-rich paint at areas scarred by welding or bolting.

3.3 SURVEY

A. Engage the services of a licensed Engineer or Surveyor to survey elevations and locations of all column and arch bases, prior to start of erection of structural steel. Any discrepancies shall be brought to the attention of the Architect. Erection shall not proceed until any required remedial measures have been completed.

B. Upon completion of the building frame provide a survey of perimeter building columns that indicates the plan deviation (as applicable) from the column grid in each direction.

3.4 TOLERANCES

A. Individual structural steel members shall be plumbed, leveled, and aligned in accordance with the requirements of Chapter 7 of the "Code of Standard Practice for Steel Buildings and Bridges", except as follows:

1. All tolerances (rolling, fabrication, erection, etc.) combined shall result in a framing in the complete structure being located within ¾ inches of its theoretical location, except that members at connections to columns shall be within 1/8 inch vertically of their theoretical elevations.

2. Tolerances for Architecturally Exposed Structural Steel (AESS) shall not exceed one-half those permitted for structural steel.

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SECTION 05 50 05

METAL FABRICATIONS

Division 3 and Structural Engineer govern this Section.

PART 1 GENERAL

1.01 REFERENCES

A. ASTM A36 - Structural Steel.

B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

C. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forges Steel Shapes, Plates, Bars, and Strip.

D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.

F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.

G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

H. ANSI/AWS Dl.l - Structural Welding Code.

I. SSPC - Steel Structures Painting Council.

1.02 DESIGN REQUIREMENTS

A. Fabricate stair assembly to support live load of 100 lb/sq. ft. with deflection of stringer or landing framing not to exceed 1/240 of span, when completed.

B. Stair Tread: Support 300 pound concentrated load, placed in position to create maximum stress, when installation is complete.

C. Balcony, Landing and Stair Railing Assembly: Upon completion, resist lateral force of 50 lbs. per linear foot applied horizontally at right angles to top rail without damage or permanent set; or 200 lbs. point load applied in any direction along the top.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit minimum 30 days prior to start of scheduled installation.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

D. Manufacturers and installers certificate that completed installation complies with design requirements of this Section.

1.04 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Sections: ASTM A36.

B. Steel Tubing: ASTM A500, Grade B.

C. Plates :ASTM A283 .

D. Pipe: ASTM A53, Grade B Schedule 40.

E. Precast Stair Treads: Minimum 11 inch deep x 1 1/2 high x length as indicated, 4000 psi at 28 day concrete, with ASTM A615 steel reinforcement, inbed plates, and broom finish on walking surface. Color as selected by Owner.

F. Bolts, Nuts and Washers: ASTM A307 galvanized to ASTM A153 for galvanized components.

G. Welding Materials: ANSI/AWS D1.1; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC 15, Type l, red oxide.

I. Touch-Up Primer for Galvanized Surfaces: Zinc rich type.

2.02 FABRICATION

A. Fit and shop assemble in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime paint items with one coat.

D. Galvanize in accordance with ASTM A123, structural steel members. Provide minimum 1.25 oz/sq ft galvanized coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field conditions are acceptable and ready to receive work.

B. Beginning installation means acceptance of existing conditions.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete with setting templates, to appropriate sections.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on Drawings.

D. Perform field welding in accordance with ANSI/AWS Dl.l

E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 SCHEDULE

A. Schedule is list of principal items only. Refer to Drawing details for items not specifically scheduled.

B. Stairs: Rolled steel channel stringers with angle tread supports for precast concrete treads, prime paint.
   1. Weld stair tread inbed plates to stringer mounted support angles, in accordance with ANSI/AWS Dl.l Standards, - OR - bolt to angles in accordance with manufacturer's written instructions.

C. Handrails: Form handrails and balusters with square and rectangular steel sections. Weld to stair stringer, and bolt to wall and floor bracket assemblies.

D. Angles and Plates: As required, prime painted or galvanized as indicated.

E. Sleeves: As required at pipe penetrations, size to allow minimum 1/4 inch between sleeve and pipe, prime painted or galvanized. Coat with Bituminous paint at penetrations of concrete or masonry.

F. Pipe Bollards: Where indicated, install 6 inch round steel pipes, fill with concrete and crown top.

END OF SECTION

SECTION 055100

PREFABRICATED STEEL STAIR SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide prefabricated and custom metal stair systems.

B. Provide rails, anchors, supports and other accessories.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete; field-poured treads and landings.

B. Section 05500 - Metal Fabrications: Building support structure and miscellaneous framing fabrications.

C. Section 09900 - Paints and Coatings; field-applied finishes.

1.3 REFERENCES

A. ASTM A36 - Standard Specification for Carbon Structural Steel.

B. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A366 - Standard Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold-Rolled.

D. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

E. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

F. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled.

G. ASTM A569 - Standard Specification for Commercial Steel (CS), Sheet and Strip, Carbon (0.16 Maximum to 0.25 Maximum Percent), Hot-Rolled.

H. AWS D1.1 - Structural Welding Code - Steel.

I. AWS D1.3 - Structural Welding Code - Sheet Steel.

J. ADAAG - Americans with Disabilities Act.

K. SSPC - Steel Structures Painting Council.

1.4 PERFORMANCE REQUIREMENTS

A. Comply with applicable code requirements and the following criteria. In case of conflict, the more stringent requirements shall govern.

B. Structural Performance of Stairs: Stairs shall withstand the following structural loads without exceeding the allowable design working stress of materials, including anchors and connections. Apply each load to produce the maximum stress in each component:
   1. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 lb/sf (4.79 kN/sq.m) and concentrated load of 300 lbf (1.33 kN) applied on an area of 4 square inches. (2580 square mm). Concentrated and uniform loads need not be assumed to act concurrently.
   2. Stair Framing: Capable of withstanding stresses resulting from loads specified in addition to stresses resulting from railing system loads.
   3. Limit deflection of treads, platforms and framing members to L/240 or 1/4 inch (6 mm), whichever is less.

C. Structural Performance of Handrails and Railings: Handrails and railings shall withstand the following structural loads without exceeding the allowable design working stress of materials, including handrails, railings, anchors and connections.
   1. Top Rail of Guardrail: Capable of withstanding a concentrated load of 200 lbf (0.89 kN) applied in any direction and a uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data
   1. Manufacturer's product information and installation manual.
   2. Submit complete Installation instruction manual as published by the Pre-engineered stair manufacture to complete this section of work.

C. Shop Drawings: Stair plans, elevations, details, methods of installation and anchoring.
   1. Show members, sizes and thickness, anchorage locations and accessory items.
   2. Furnish setting diagrams for anchorage installation as required.
   3. Shop drawings shall include calculations stamped by a structural engineer registered in the jurisdiction in which the project is located.

D. Verification Samples: For each finished tread product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, finish, and patterns. (Finished Tread is only sample available for submittal).

1.6 QUALITY ASSURANCE

A. Manufacture to have a minimum of 10 years experience in the design, engineering and fabrication of steel stairs, and must offer these turn-key services to complete this section of work.

B. Regulatory Requirements: Comply with applicable provisions of local building code, ADAAG and ANSI A117.1 as applicable for stairs and handrails.

C. Welding: Perform shop and field welding in accordance with applicable recommendations of the American Welding Society. Use only welders who have been certified by AWS D1.1 testing within one year of contract date.

D. Tolerances: Coordinate fabrication and installation of stair and railing systems with adjacent building construction and verify critical dimensions to ensure accurate installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver stair and rail components in Manufacturer's pre-bundled protective wrapping, clearly labeled for stair type and location in building.

B. Storage and Protection: Store stair and rail components above ground, protected from exposure to the elements and from physical damage caused by other construction activities. Rusted, bent, warped or otherwise damaged units will not be accepted.

1.8 PROJECT SITE CONDITIONS

A. Field Measurements: General Contractor will provide guaranteed field measurements if schedule does not allow for physical dimensioning. Otherwise field verify floor to floor and horizontal dimensions of spaces where stairs will be installed prior to fabrication of stairs under this section.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Sharon Companies Ltd.; 959 Lake Road, Medina, OH 44256. ASD. TEL: (330) 723-3225. FAX (330) 723-2350. Email: sales@sharonstair.com www.sharonstair.com.

B. Substitutions: As approved per architect prior to bid date.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MATERIALS

A. Steel Shapes and Plates: ASTM A36:

B. Steel Pipe: ASTM A53, Type E or S, Grade B.

C. Steel Tubing:
1. Structural use: ASTM A500, Grade B or C.
2. Non-Structural Use: ASTM A513, hot rolled or coiled rolled (mill option).

D. Steel Sheet:
1. Structural use: ASTM A570 (hot rolled) or A366 (cold rolled).
2. Non-Structural Use: ASTM A569 (hot rolled) or A366 (cold rolled).

E. Fasteners and Accessories:
1. Provide all necessary anchor bolts, clip angles, hanger rods and other hardware, accessories and incidental materials required for complete installation of stairs and rails.

F. Welding Materials: Conform to AWS code and AWS filler metal specifications for material being welded.

G. Primer: Acrylic Latex rust-inhibitive primer containing less than 1.0 lb/gal volatile organic compounds (VOC), certified to be compatible with finish coats specified in section 09900.

H. Concrete Materials and Reinforcement: Comply with the applicable requirements of Section 03300.

2.3 FABRICATION

A. General:
   1. Use same material and finish as parts being joined, except use stainless steel between dissimilar metals and non-corrosive fasteners at exterior connections or joints.
   2. Provide fasteners of sufficient strength to support connected members and loads, and to develop full strength of parts fastened or connected.
   3. Construct stairs and rails with all components necessary for support and anchorage, and to provide a complete installation.

2.4 STANDARD STAIR AND RAIL SYSTEM

A. Manufacturer's standard prefabricated, pre-engineered straight run stair and landing system, consisting of hot rolled steel sheet treads, risers and landings. Stringers to be steel plate or channel with side mounted prefabricated railings.
   1. Stringers: Minimum thickness or gauge as determined by structural design calculations, structural grade steel plate and or channel.
   2. Risers: Closed riser, minimum 14-gauge (1.7 mm) hot-rolled mild steel sheet, sloped maximum 1-1/2 inches (38 mm) and conforming to ADAAG nosing requirements.
   3. Treads: Manufactures standard Precast Tread System, adjustable and bolted to closed riser and tread support system.
   4. Mid Landings: Minimum of 11 gauge (3 mm) hot-rolled mild steel sheets, formed for a minimum 3 inches (76 m) concrete fill, with 12 gauge channel supports and bracing welded to perimeter frame at 12 inches (305 mm) o.c.
   5. Fasteners and Supports: Sized by the Manufacturer to meet the structural design criteria. If hanger rod connections are applicable to any of the landing connections, they shall be a minimum of 5/8 inch (16 mm) diameter steel rod, actual size based on stair load.

B. Manufacturer's standard welded steel tube railing system complying with the following requirements:
   1. Rails: 1-1/2 inches (38 mm) diameter by minimum 16 gauge round steel tube, continuous multi strand type, equally spaced not more than 3-15/16 inches (100 mm) clear between strands, and with a minimum extension per code at top and bottom risers. Wrap rail continuously past space between fights to form guardrail as required by building code. Terminate rail ends with radiused returns, newel posts, or safety terminations approved by local code. Provide not less than 1-1/2 inches (38 mm) clear between rail and wall.
   2. Rail Posts: 1-1/2 inches (38 mm) square by 11 gauge (3 mm) tubing. Rail posts to fasten to side of plate stringers per manufactures shop drawings. Manufacture to pre-weld erection aid to rail post for proper height to aid stair erector. Erection aid (Setting block) to be removed and weld ground smooth after installation.
   3. Fabrication:
      a. Use preformed or prefabricated bends.
      b. Butt weld tee and cross intersections in tubing: cope and weld intersections in pipe. Miter elbows.
      c. Mechanically fasten internal sleeves and fittings.
      d. Provide minimum 3/16 inch (5 mm) welded steel plate closures or hemispherical closure fittings on all exposed rail ends.

C. Custom welded steel railing system complying with the following requirements:
   1. Rails: 1-1/2 inches (38 mm) diameter by minimum 16 gauge round steel tube, continuous multi strand type, equally spaced not more than 3-15/16 inches (100 mm) clear between strands, and with a minimum extension per code at top and bottom risers. Wrap rail continuously past space between fights to form guardrail as required by building code. Terminate rail ends with radiused returns, newel posts, or safety

terminations approved by local code. Provide not less than 1-1/2 inches (38 mm) clear between rail and wall.

2. Rail Posts: ½" x 3 inches (38 mm) bar stock. Rail posts to fasten to side of plate stringers per details as indicated in the Architectural and ID drawings.. Manufacture to pre-weld erection aid to rail post for proper height to aid stair erector. Erection aid (Setting block) to be removed and weld ground smooth after installation.
3. Top Guard Cap – 1 1/2' x 3" (As indicated in Architectural Drawings)
4. Fabrication:
   a. Use preformed or prefabricated bends.
   b. Butt weld tee and cross intersections in tubing: cope and weld intersections in pipe. Miter elbows.
   c. Mechanically fasten internal sleeves and fittings.
   d. Provide minimum 3/16 inch (5 mm) welded steel plate closures or hemispherical closure fittings on all exposed rail ends.

D. Wall Handrails: Match stair handrails. Provide manufacturer's standard pressed steel wall brackets with anchors suitable for supporting construction.

E. Barrier Gates: Manufacturer's standard swing gate assembly with steel spring hinges and rubber bumper between barrier/gate assembly and rail post.

2.5 SHOP CLEANING AND FINISHING

A. Rails and Stair Components: Completely remove oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter from surface of steel in accordance with SSPC-SP3, "Power Tool Cleaning."

B. Shop Primer: Immediately after shop fabrication and cleaning, spray apply primer to a minimum dry film thickness as recommended by primer manufacture, but not less than 2.0 mils. Apply one coat hi-solids red oxide anti corrosive primer meeting federal specifications TT-664, TT-P-636, and SSPC1364.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates and adjacent construction have been properly constructed. Verify structural framing, enclosures, weld plates, blocking, and size and location of pockets.

B. If unsatisfactory conditions are encountered, notify Architect in writing. Do not proceed until unsatisfactory conditions have been corrected.

C. Notify Manufacturer of any detail, design or tolerance deviations as noted or drawn on stair shop drawing.

3.2 INSTALLATION

A. Install stairs, landings and handrails in accordance with manufacturer's instructions. Install square, plumb, straight, and true to line and level, with neatly fitted joints and intersections.
   1. Welds in area of travel shall be ground smooth.
   2. Do not cut or alter structural components without written authorization.
   3. Field welding and joining shall conform to AWS D1.1 and AWS D1.3 requirements.
   4. Installation shall be secure and rigid.
   5. Landing and flights properly spaced and within Manufacturer's tolerance. Set railing level and uniformly spaced.

6. Attach rail post to stringers and install wall railing per approved shop drawings.
7. Grind all exposed welds smooth and touch up shop-primed areas with same primer as used by Manufacturer.

3.3 ADJUSTING AND CLEANING

A. Touch-up field welds and abraded areas by application of same coating used for shop primer.

B. Repair or replace damaged components.

C. After stairs are completely installed, remove all construction debris and rubbish from area. Clean surface of exposed rail and stairs with wet cloth or mop. Leave stair system ready for finish painting.

END OF SECTION

SECTION 055200

EXTERIOR METAL ORNAMENTAL RAILINGS

1.0 GENERAL

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

B. Structural Performance of Railing Systems: Comply with ASTM E 985 based on testing per ASTM E 894 and E 935.

C. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Submittals: In addition to product data, submit the following:

1. Shop drawings signed and sealed by a Structural PE registered in the state of the project location, showing railing layout, railing connections/fasteners, and details of components, with structural computations.
2. Samples of each type of metal finish indicated.
3. Test reports from independent testing agency showing compliance with ASTM E985.

2.0 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide handrails and railing systems from a single manufacturer/fabricator. Submit to Architect/Owner for approval.

B Aluminum Alloy and temper recommended by aluminum producer and finisher for use and finish indicated, and with not less than the strength and durability of the alloy and temper designated:

1. Extruded Bar and Tube: ASTM B 221 (ASTM B 221M), alloy 6063T5/T52.
2. Drawn Seamless Tube: ASTM B 210 (ASTM B 210M), 6063-1832.
3. Plate and Sheet: ASTM B 209 (ASTM B 209M), 606 1-T6.
4. Die and Hand Forgings: ASTM B 247 (ASTM B 247M'), 606 1-16.
5. Castings: ASTM B 26/B 26M., A356-T6.

C. Fasteners: Same basic metal as the fastened metal; concealed unless otherwise indicated or unavoidable and standard with systems indicated.

D. Anchors and Inserts: Fabricated from corrosion-resistant materials, capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in masonry and 4 times the load imposed when installed in concrete as determined per ASTM E 488.

E. Grout/Anchoring Cement: Premixed, non-shrink, nonmetallic grout complying with ASTM C 1107 or erosion-resistant anchoring cement; non-staining, non-corrosive, nongaseous; recommended by manufacturer for applications indicated.

F Fabrication, General: Fabricate railings to design, dimensions, and details indicated and as required to support structural loads.

Top Rails of Guardrail Systems: Concentrated loads of **200**lbf applied at any point and a uniform load of **50** lbs per linear ft. with each load applied non-concurrently with respect to direction and each other, vertically downward or horizontally.

Handrails not serving as Toprails: Concentrated loads of 200lbs applied at any point and a uniform load of 50 lbs per linear ft. with each load applied non-concurrently with respect to direction and each other, vertically downward or horizontally.

Infill Area of Guardrail Systems: Horizontal concentrated load of **50** lbs applied to one SF at any point in the system including panels, intermediate rails balusters, or other elements composing the

infill area.

1. Welded Connections: Use fully welded joints for connecting railing components. Cope and butt weld or weld in internal fittings.
2. Non-welded Connections: Fabricate railing members for connecting with concealed mechanical fasteners and fittings.
   a. Fabricate splice joints for field connection using epoxy structural adhesive.
3. Form changes in direction of members as follows:
   a. By inserting prefabricated flush elbow fittings.
   b. By bending.
   c. By mitering.
   d. By any method indicated above, applicable to change of direction involved.
4. Form curves by bending in jigs to produce uniform curvature without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

G. Aluminum, Baked Enamel Finish: AA-C12C42R1X, Organic Coating. Thermosetting modified acrylic enamel primer/topcoat system complying with AAMA 603.8 with minimum dry film thickness of *1.5* mils medium gloss.
   1. Color: As selected from manufacturer's standard colors.

3.0 EXECUTION

A. Installation, General: Perform cutting, drilling, and fitting required for installing railings. Set units accurately in location, alignment, and elevation.

B. Anchor posts to metal surfaces with fittings designed for this purpose.

C. Anchor guardrail ends to concrete and masonry with round flanges connected to rail ends and anchored to wall construction with drilled-in expansion anchors.

D. Secure guardrail to wall with wall brackets and end fittings.
   1. **Refer to Drawings/Details Sheets for railing profiles and design. Verify with Architect.**

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

Division 3 and Structural Engineer govern this Section.

PART 1 GENERAL

1.01 REFERENCES

A. ASTM E84 - Test Method For Surface Burning Characteristics of Building Materials.

B. ANSI-AF & PA NDS-2001 – National Design Specification for Wood Construction.

C. APA: American Plywood Association.

D. AWPA: American Wood Preservers Association C1 - All Products Preservative Treatment by Pressure Process.

E. NFPA: National Forest Products Association.

F. SPIB: Southern Pine Inspection Bureau.

G. ANSI/TPI 1-2014 – National Design Standard for Metal Plate Connected Wood Truss Construction.

H. WCLIB: West Coast Lumber Inspection Bureau.

I. WWPA: Western Wood Products Association.

J. BCSI 1-03 – Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses.

1.02 DESIGN REQUIREMENTS

A. Shear Walls: Design in strict accordance with Building Code requirements.

1.03 SUBMITTALS

A. Submit under provisions of Section 013000.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:
   1. Lumber Grading Agency: Certified by ALSC.
   2. Plywood Grading Agency: Certified by APA.

3. Treated Lumber: Certified by AWPA.

B. Truss Design, Fabrication, and Installation: In accordance with Truss Plate Institute, ANSI-TPI 1-2014.

C. Shear Walls: Refer to Structural Drawings for details.

1.05 QUALIFICATIONS

A. Truss Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Design trusses under direct supervision of Professional Structural Engineer experienced in design of the Work and Licensed in State where Project is located.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber: Refer to Structural Drawings for species and strengths.

B. Wood Trusses: Southern Pine or Douglas Fir Larch with fiber stress as required, and mechanically galvanized plates.

C. Decking: Plywood or Oriented-Strand Board (OSB).
l. Subfloor: APA rated sheathing 48/24 exposure 1 size as noted on plans.
2. Roof Deck: APA rated sheathing 24/16 exposure 1 size as noted on plans.

D. Sheathing:
1. Plywood or OSB Sheathing: APA rated exposure l, size as noted .

E. Pressure Treated Products: In accordance with AWPA standard C2 for above ground applications.

G. Fasteners and Anchors: As required, Hot-Dipped galvanized steel for high humidity areas and treated wood locations, unfinished steel elsewhere.

H. Adhesive for plywood subflooring: Conform to performance specification AFG-01 as developed by APA.

2.02 FABRICATION

A. Fabricate wood trusses to achieve requirements indicated.

2.03 FACTORY WOOD TREATMENT

A. Wood Preservative Treatment: In accordance with AWPA C2 for above ground application.

PART 3 EXECUTION

3.01 FRAMING

A. Set structural members level and plumb, in correct position.

B. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Place horizontal members flat, crown side up.

D. Splicing of load bearing members only as allowed in Structural Plans and Specifications.

E. Double members at openings. Space short studs over and under opening to stud spacing.

F. Install wood blocking, nailers, ground, furring, etc. required for securing work of other trades. Secure blocking to receive, engage or support other work.

G. Truss handling, installation, and bracing in accordance with BCSI 1-03.

3.02 DECKING GLUE AND NAIL

A. Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.

B. Secure floor and roof decking perpendicular to framing members with ends staggered and sheet ends over firm bearing. Gap ends in accordance with manufacturer's instructions.

C. Secure floor decking to trusses with construction adhesive and No. 6d ringed shank nails, adhesive applied as 3/8 inch diameter bead to top chord of trusses and grooved edges of decking.

D. Shear Walls: Install plywood or OSB panel sheathing where indicated, in strict accordance with local Building Code requirements and per Structural Engineer. Protect all areas from weather with felt or Tyvek weatherization system.

3.03 WOOD TREATMENT

A. Field treat cuts and holes with swabbing of concentrated solution of same preservative as originally applied in accordance with AWPA Standards.

END OF SECTION

SECTION 06 17 00

SHOP-FABRICATED STRUCTURAL WOOD

1.1 WORK INCLUDED

Design, manufacture, and supply wood trusses as shown on Structural Design Documents and as specified.

1.2 DEFINITIONS

A. Building Designer: The Owner of the Building or the individual or organization (including either an Architect or Engineer or the Contractor) that contracts with the Owner for the design of the Building Structural System and/or who produces the Structural Design Documents.

B. Contractor: The Owner of the Building or the individual or organization who contracts with the Owner for the construction of the Building Structural System. The Owner of the Building or the individual or organization who contracts with the Owner and is responsible for the construction of the Building Structural System in accordance with all Legal Requirements. The term "Contractor" shall include those subcontractors who have a direct contract with the Contractor to perform all or a portion of the storage, handling, installation, and bracing (temporary and permanent) of the Trusses.

C. Structural Design Documents: Written, graphic and pictorial architectural or structural documents, specifications and addenda prepared or assembled for the overall construction of the Building Structural System, which are part of the Construction Documents.

D. Truss: An individual metal plate connected wood component supplied for the Building Structural System.

E. Truss Designer: The individual or organization responsible for the design of Trusses.

F. Truss Design Drawing: The written, graphic and pictorial depiction of an individual Truss.

G. Truss Manufacturer: An individual or organization engaged in the manufacturing of Trusses.

H. Truss Placement Diagram: The illustration supplied by the Truss Manufacturer

I. Identifying the location assumed for each Truss, which references each individually designated Truss Design Drawing.

J. Truss Submittals: The Truss Design Drawings, and the Truss Placement Diagram if required by the Contract, submitted by the Truss Manufacturer to the Local Building Official, Owner, Building Designer and/or Contractor for their review and/or approval.

1.3 DESIGN

A. Trusses shall be designed in accordance with this specification and where any applicable design feature is not specifically covered herein, design shall be in accordance with the applicable provisions of the latest edition of the American Forest & Paper Association's (AF&PA's) National Design Specification® (NDS®) for Wood Construction, ANSI/TPI 1, and all applicable legal requirements.

B. Truss Manufacturer shall furnish Truss Design Drawings prepared in accordance with all applicable legal requirements.

C. Truss Manufacturer shall furnish a Truss Placement Diagram which shall provide at a minimum the location assumed for each Truss based on the Truss Manufacturer's interpretation of the Structural Design Documents

D. Truss Manufacturer shall submit the Truss Submittals to the Building Designer and/or the local building official for review and approval prior to the manufacturing of the Trusses.

E. The Truss Design Drawings shall include as minimum information:

- **1.** Slope or depth, span, and spacing;
- **2.** Location of all joints;
- **3.** Required bearing widths;
- **4.** Design loads as applicable:
  - **a.** Top chord live load (including snow loads);
  - **b.** Top chord dead load;
  - **c.** Bottom chord live load;
  - **d.** Bottom chord dead load;
  - **e.** Concentrated loads and their points of application; and
  - **f.** Controlling wind and earthquake loads expressed in units of force per unit area;
- **5.** Adjustments to lumber and metal connector plate design values for conditions of use;
- **6.** Each reaction force and direction;
- **7.** Metal connector plate type, size, thickness or gauge, and the dimensioned location of each metal connector plate except where symmetrically located relative to the joint interface;

8. Lumber size, species, and grade for each member;
Connection requirements for:
- **a.** Truss to Truss girder
- **b.** Truss ply to ply
- **c.** Field assembly of Trusses

9. Calculated deflection ratio or maximum deflection for live and total load;

10. Maximum axial compression forces in the Truss members to enable the building designer to design the size, connections, and anchorage of the permanent continuous lateral bracing; and

11. The approximate location for continuous lateral permanent bracing of Truss members subject to buckling due to compression forces.

2.1 MATERIALS

A. Lumber

1. Lumber used shall be identified by grade mark of a lumber inspection bureau or agency approved by the American Lumber Standards Committee, and shall be the size, species, and grade as shown on the Truss Design Drawings, and as approved by the Truss Designer and Building Designer.

2. Moisture content of lumber shall be no less than 7% at time of manufacturing.

3. Adjustment of value for duration of load or conditions of use shall be in accordance with NDS.

4. Fire retardant treated lumber, if applicable, shall meet the specifications of the fire retardant chemical manufacturer, the Truss design and ANSI/TPI 1 and shall be re-dried after treatment in accordance with AWPA Standards C20. Allowable values must be adjusted in accordance with NDS. Lumber treater shall supply certificate of compliance.

B. Metal Connector Plates:

1. Metal connector plates shall be manufactured by a Wood Truss Council of America ("WTCA") member plate manufacturer and shall not be less than 0.036 inches in thickness (20 gauge) and shall meet or exceed ASTM A653/A653M grade 33, and galvanized coating shall meet or exceed ASTM A924/924M, coating designation G60. Working stresses in steel are to be applied to effectiveness ratios for plates as determined by test and in accordance with ANSI/TPI 1.

2. In highly corrosive environments, special applied coatings or stainless steel may be required.

3. At the request of Building Designer, a WTCA member plate manufacturer shall furnish a certified record that materials comply with steel specifications.

2.2 MANUFACTURING

A. Trusses shall be manufactured to meet the quality requirements of ANSI/TPI 1 and in accordance with the information provided in the final approved Truss Design Drawings.

3.1 HANDLING, EXECUTION, INSTALLING, AND BRACING

A. Trusses shall be handled during manufacturing, delivery and by the Contractor at the job site so as not to be subjected to excessive bending.

B. Trusses shall be unloaded in a manner so as to minimize lateral strain. Trusses shall be protected from damage that might result from on-site activities and environmental conditions. Trusses shall be handled in such a way so as to prevent toppling when banding is removed.

C. Contractor shall be responsible for the handling, installation, and temporary bracing of the Trusses in a good workmanlike manner and in accordance with the recommendations set forth in WTCA/TPI's Building Component Safety Information BCSI 1-03: Guide to Good Practice For Handling, Installing & Bracing of Metal Plate Connected Wood Trusses.

D. Apparent damage to Trusses, if any, shall be reported to Truss Manufacturer prior to erection.

E. Trusses shall be set and secured level and plumb, and in correct location. Each Truss shall be held in correct alignment until specified permanent bracing is installed.

F. Cutting and altering of Trusses is not permitted. If any Truss should become broken, damaged, or altered, written concurrence and approval by a licensed design professional is required.

G. Concentrated loads shall not be placed on top of Trusses until all specified bracing has been installed and decking is permanently nailed in place. Specifically avoid stacking full bundles of plywood or other concentrated loads on top of Trusses.

H. Truss Submittals and any supplementary information provided by the Truss Manufacturer shall be provided by the Contractor to the individual or organization responsible for the installation of the Trusses.

I. Trusses shall be permanently braced in a manner consistent with good building practices and in accordance with the requirements of the Structural Design Documents. Trusses shall furthermore be anchored or restrained to prevent out-of-plane movement so as to keep all Truss members from simultaneously buckling together in the same direction. Such permanent lateral bracing shall be accomplished by: **a.** anchorage to solid end walls
b. permanent diagonal bracing in the plane of the web members
c. other suitable means.

J. Materials used in temporary and permanent bracing shall be furnished by Contractor.

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SECTION 062000

FINISH CARPENTRY

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior standing and running trim.
   2. Exterior trim.

1.2 REFERENCES

A. American Plywood Association (APA): Product Guide-Grades and Specifications.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300:
   1. Samples: Minimum 6-inch long samples of each interior trim profile.

1.4 QUALITY ASSURANCE

A. Rated Sheathing Grading Agency: Certified by APA.

B. Identify lumber and Rated Sheathing by official grade mark.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:

1. Interior trim:

- 3/8 x 5 1/4" painted base
- 11/16 x 2 1/4" painted colonial casing at swing patio doors
- 3/4" x 6 3/4" painted wall caps with apron
- 1 x 6 painted window sill with apron
- 1/4" round trim under countertops and wall intersections

B. Public Area Trim Material

1. Public Area

- F640 5 1/4" Painted crown @ clubhouse only
- F2800 5 1/4" Painted base
- 1 x 6 Painted window sill with apron
- F720 11/16 x 2 5/8" painted chair rail
- F704 1/2 x 1 1/2" painted panel molding

C. Exterior trim: Species and grade to be selected by Owner. Trim to be Prefinished or Field Painted (Contractor Option) Color as approved by Owner

Rated Sheathing Soffits and Trim:

1. Soffits to be Cementitious Panel – Vented Smooth Cementitious Soffit with Non Vented Smooth Cementitious Soffit Over all window openings
2. Exposure: Exterior.

Rough Hardware: Type and size as required by conditions of use; plain steel or aluminum for interior use, hot dip galvanized steel for exterior use.

2.2 ACCESSORIES

A. Rough Hardware: Type and size as required by conditions of use; plain steel or aluminum for interior use, hot dip galvanized steel for exterior use.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, condition interior trim to average humidity which will prevail after installation.
B. Back prime wood installed against cementious materials prior to installation.

3.2 INSTALLATION

A. Interior Standing and Running Trim:
   1. Secure in place rigid, plumb and level.
   2. Miter corners and end joints.
   3. Scribe to adjacent construction with maximum 1/32-inch gaps.
   4. Countersink exposed fasteners to receive putty.

B. Exterior Standing and Running Trim:
   1. Install in longest practical lengths.
   2. Miter ends, corners, and intersections.
   3. Secure to supporting construction.

C. Install with minimum number of joints possible, using full length pieces (from maximum length of lumber available) to greatest extent possible. Stagger joints in adjacent and related members. Cope at inside corners, miter at returns and outside corners, and comply with quality standard for joinery.

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 a complete installation. Except where prefinished matching fasteners are required, use fine finishing nail exposed nailing, set filled flush with woodwork.

E. Installation Tolerances:
   1. Maximum variation from true position: 1/16 inch.
   2. Maximum offset from true alignment of abutting surfaces: 1/16 inch.

END OF SECTION

SECTION 06 43 00

WOOD STAIRS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood stairs and railings, including rough carriages for stairs.
2. Shop finishing of wood stairs and railings.

1.2 ACTION SUBMITTALS

A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1.3 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wood stairs and railings until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WOOD STAIRS AND RAILINGS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

B. Grade: Custom.

C. Wood for Opaque Finish: Any closed-grain hardwood except that eastern white pine, sugar pine, or western white pine may be used for risers, stringers, and moldings.

D. Finishes for Stair Parts: As follows:

1. Treads: Preformed rubber treads.
2. Risers: Rubber cove base.
3. Stringers: Paint.
4. Balusters: Paint.
5. Handrails: Paint.
6. Scotia, Cove, and Other Moldings: Paint.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.

2.4 FABRICATION

A. Fabricate wood stairs and railings to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Cut carriages to accurately fit treads and risers. Glue treads to risers, and glue and nail treads and risers to carriages.

1. Fabricate stairs with treads and risers no more than 1/8 inch (3 mm) from indicated position and no more than 1/16 inch (1.5 mm) out of relative position for adjacent treads and risers.

2.5 SHOP FINISHING

A. General: Finish wood stairs and railings at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork.

C. Opaque Finish:

1. Semi-gloss – Second and Third Coat :
   a. Sherwin-Williams Solo 100% Acrylic Semi-Gloss, A76 Series.
   b. PPG Speedhide 6-500 6-1110XI.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood stairs and railings to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install wood stairs and railings to comply with same grade as item to be installed.

B. Stairs: Securely anchor carriages to supporting substrates. Install stairs with treads and risers no more than 1/8 inch (3 mm) from indicated position.

C. Railings:

1. General: Install rails with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.
2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
3. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.

D. Touch up finishing work specified in this Section after installation of wood stairs and railings. Fill nail holes with matching filler where exposed.

END OF SECTION

SECTION 071300

BALCONY SHEET MEMBRANE WATERPROOFING SYSTEM

PART 1 - GENERAL

A. The Sheet Membrane Waterproofing Membrane and accessory flashing and sealing components specified in this Section include the following:

1. Elastomeric waterproofing sheet membrane.
2. Sheet Metal Flashing and Counter Flashing
3. Aluminum T Bar Edge Materials
4. Elastomeric Spacers and Other Accessories

B. Related Documents:

1. As a guide for the complete warranted balcony waterproofing system, refer to the attached waterproofing assembly details for sheet metal edge flashing, base flashing, counter flashing, membrane joint treatment, concrete deck topping, fasteners, etc., as part of a Positive Drainage System (example included). This system or a complete waterproofing system as provided by W R Grace, W R Meadows, Tamko, or Farris Floor Systems may be submitted in accordance with Section 013000 shall.

2. Refer to Section 033116 "Concrete Toppings" and Section 076200 "Flashing and Sheet Metal for additional requirements related to the balcony sheet membrane waterproofing system.

C. Project Conditions: Comply with sheet membrane manufacturers written project condition instructions and procedure requirements. Proceed with work after substrate construction, openings, and penetrating work have been completed and areas are free from standing water.

D. Start waterproofing and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers recommendations and warranty requirements.

E. Warranty: Submit a written warranty executed by the manufacturer agreeing to replace or repair sheet membrane waterproofing that fails in materials or workmanship within specified warranty period. This warranty shall be in addition to, and not a limitation to other rights the Owner may have against the Contractor under the Contract Documents.

1. Sheet membrane waterproofing system: Provide written ***5*** year material and system warranty issued by the waterproofing system manufacturer and installer upon completion of the work.

F. Installer: The installers of the system shall be experienced in the manufacturer's requirements. Installers shall possess a minimum of 3 years experience in system installation. A single installation contractor/supplier shall install the complete system including final concrete topping and finish sealants. The manufacturer's representative shall approve the substrate prior to installation of the membrane and flashing. The manufacturer's representative shall approve the installed waterproof membrane, flashing and all seams/seals prior to the installation of the lightweight concrete topping.

PART 2 - PRODUCTS

A Provide complete waterproofing balcony deck system as indicated on the drawings. System includes, but not limited to the following:

1. 60 mil self-adhering elastomeric waterproofing membrane over wood deck with lapped and sealed membrane joints.
2. Shop fabricated 26 gauge metal flashing, welded Balcony Swing and Sliding Glass Door Sill Pan, base flashing and counter flashing for various curbs, doorways, inside and outside corners, and edge conditions as indicated on the attached manufacturers detail sheet no. 1 through 14
3. Provide extruded aluminum T-bar with drip edge and 26 gauge metal drip edge flashing. Set T-bar on 60 mil 4" x 4" ~ 12" O.C. elastomeric spacers for positive drainage of membrane to drip edge.
4. Provide complete sealed, metal "end dam/diverter" system for the purpose of preventing water intrusion at all "T Bar" end conditions.
5. Concrete topping over membrane is also considered part of the total deck waterproofing membrane system and is specified in Section 033116.

B. Auxiliary Materials: Provide the following materials to suit Project conditions:

1. Adhesives: Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer for bonding to substrate (if required), for waterproofing seams in membrane, and for waterproofing joints between membrane and flashings, adjoining surfaces, and projections through membrane.
2. Primers: Provide type of primer recommended by manufacturer of sheet waterproofing material for application required.
3. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material. for flashing as recommended by waterproofing sheet manufacturer.
4. Protection Board: Provide type of protection board recommended by waterproofing sheet manufacturer. Include adhesives recommended by manufacturer.

PART 3 - EXECUTION

A. Preparation: Comply with manufacturer's instruction for preparing surface.

B. Installation: Comply with manufacturer's instructions for handling and installing sheet waterproofing materials.

1. Coordinate installing waterproofing materials with associated work to provide complete system complying with combined recommendations by manufacturers and installers involved in Work. Schedule installation to minimize period of exposure of sheet waterproofing materials.
2. Extend waterproofing sheet and flashings as shown to provide complete membrane over area indicated to be waterproofed. Seal projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.

C. Water Testing: Water test all membrane installations prior to of concrete topping.

D. Cleaning: After completion, remove any masking materials and stains from exposed surfaces caused by waterproofing installation.

E. Protection: Protect completed membrane during installation of other work over membrane and throughout remainder of construction period. Do not allow traffic of any type on unprotected membrane.

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"POSITIVE DRAINAGE" WATERPROOFING SYSTEM DRAWINGS & DETAILS

UNITED STATES OF AMERICA PATENT # 5546719

SHEET	DESCRIPTION	SHEET	DESCRIPTION
ONE	FULL VIEW OF TYPICAL BALCONY/BREEZEWAY	EIGHT	FLASHING DETAIL @ INSIDE CORNER
TWO	VIEW OF TYPICAL BALCONY/BREEZEWAY EDGE	NINE	BASE-FLASHING SPECIFICATIONS
THREE	ISOMETRIC VIEW OF BALCONY/BREEZEWAY EDGE	TEN	COUNTER FLASHING SPECIFICATIONS
FOUR	TYPICAL DOOR ENTRY DETAIL	ELEVEN	EAVE FLASHING SPECIFICATIONS
FIVE	INSTALL PROCEDURES FOR DOOR ENTRY - (STEPS 1 & 2)	TWELVE	TYPICAL LAP DETAILS
SIX	INSTALL PROCEDURES FOR DOOR ENTRY - (STEPS 3 & 4)	THIRTEEN	METAL FLASHING OVERLAP DETAIL
SEVEN	FLASHING DETAIL @ OUTSIDE CORNER	FOURTEEN	ALUMINUM T-BAR SPECIFICATIONS

MILLER, MILLER, & MAC'S
"POSITIVE DRAINAGE"
WATERPROOFINGSYSTEM
EXTRUDED ALUMINUM
T-BAR W/DRIP EDGE
26 GAUGE DRIP
EDGE FLASHING
LAP SEALANT
26 GAUGE COUNTER
FLASHING 3" X 4"
3000 P.S.I. CONC.
W/ 1/8" SLOPE
PER FOOT
WOOD DECK
60 MILLIMETER ELASTOMERIC
WATERPROOFING MEMBRANE
LAP SEALANT
26 GAUGE 4" X 6"
BASE FLASHING
FULL VIEW OF TYPICAL
BALCONY/BREEZEWAY
LIC PAT. # 6546719
JOB #
COMPANY
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& MAC FL. INC.
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DESIGNED BY
CHARLES P. MAIERS
GERALD J. MAIERS
DRAWN BY
CHRIS CLINGERMAN
DWG NO. / FILE NAME
WP1.skd
REVISED
SEPTEMBER 11, 1996
SCALE
N. T. S.
DATE
9/6/96
SHEET
ONE

EXTRUDED ALUMINUM
T-BAR W/DRIP EDGE
26 GAUGE DRIP
EDGE FLASHING
SPACED AS NEEDED FOR SIDING
AND STUCCO APPLICATIONS
60 MILLIMETER ELASTOMERIC T-BAR
SPACER 4" X 4" @ 12" O.C. MAX.
60 MILLIMETER ELASTOMERIC
WATERPROOFING MEMBRANE
WOOD DECK
WOOD TRUSSES
US PATENT # 5546719
LOS #
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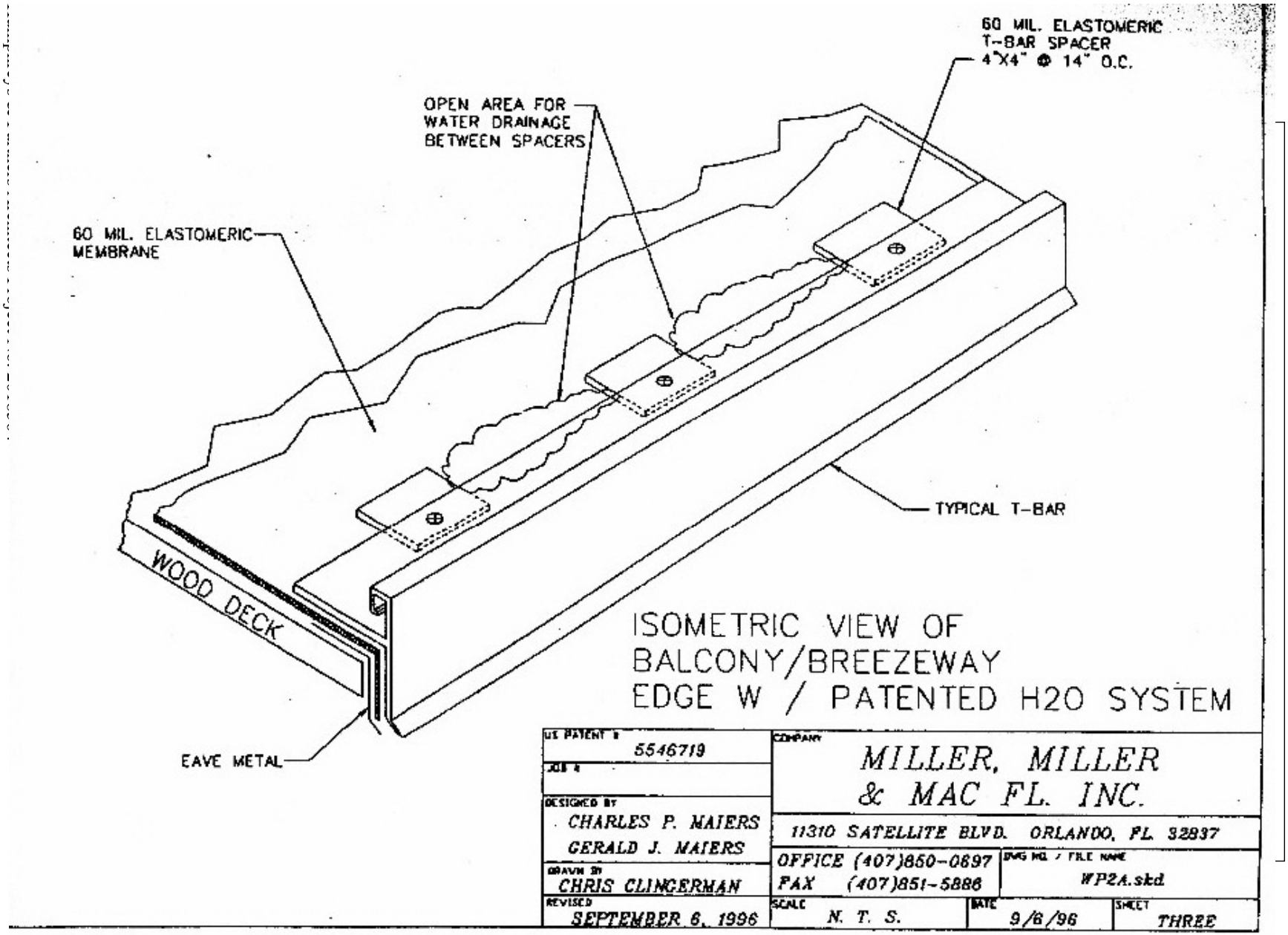
WP2.skd
SCALE
N. T. S.
DATE
9/6/96
SHEET
TWO



ISOMETRIC VIEW OF BALCONY/BREEZEWAY EDGE W / PATENTED H2O SYSTEM

US PATENT # 5546719	COMPANY: MILLER, MILLER & MAC FL. INC.
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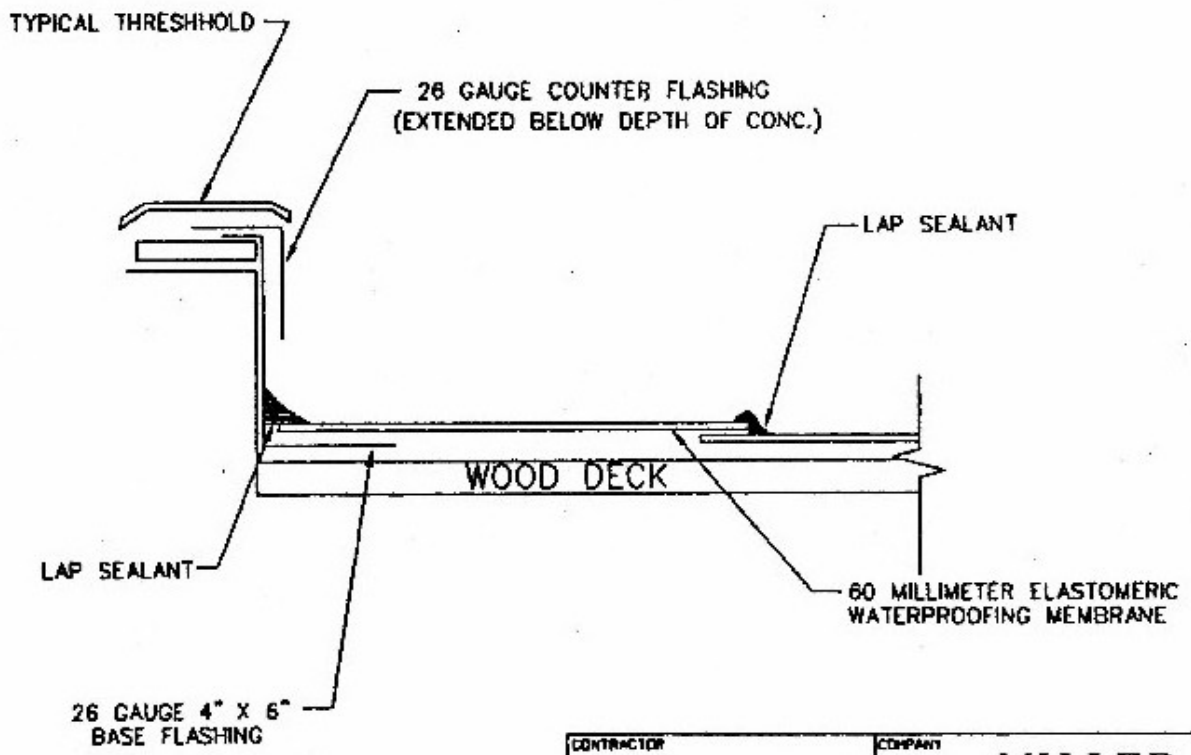
071300-7

071300-8

TYPICAL DOOR ENTRY
@ BALCONY/BREEZEWAY



CONTRACTOR	COMPANY: MILLER, MILLER & MAC FL. INC.
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SCALE: N. T. S.	DATE: 9/6/96
SHEET: FOUR	

METAL
L-BRACKET
WOOD DECK
STEP 1
4"X6" BASE
FLASHING
WOOD DECK
STEP 2
STEP 1: INSTALL METAL
L-BRACKET.
STEP 2: INSTALL BASE FLASHING
W/ 45° CUTS OVER L-BRACKET.
FOR STEPS 3 & 4 SEE DWG. WP3B
US PAT # 5546719
JOB # 000
DESIGNED BY CHARLES P. MAIERS
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DWG NO. / FILE NAME WP3A.skd
SCALE N. T. S.
DATE 9/10/96
SHEET FIVE

STEP 3: INSTALL JS 500 FORM FLASH OVER INSTALLED L-BRACKET AND 4"X6" BASE FLASHING.
STEP 4: INSTALL COUNTER FLASHING W/ 1" TABS OVER INSTALLED JS 500 FORM FLASH & MASTIC COUNTER FLASHING TERMINATION.
6"X6" JS500 FORMFLASH (TYP)
3"X4" COUNTER FLASHING
MASTIC @ COUNTER FLASHING TERMINATION
WOOD DECK
STEP 3
STEP 4
L-BRACKET & JS 500 FORM FLASH OMITTED FOR CLARITY.
CONTRACTOR
JOB #
DESIGNED BY
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SCALE
N. T. S.
DATE
9/10/96
SHEET
SIX

FLASHING DETAIL @
OUTSIDE CORNER
STEP 1: INSTALL L-BRACKET
STEP 2: INSTALL BASE FLASHING
W/ GALVANIZED ROOFING NAILS
CONTRACTOR
JOB #
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OFFICE (407)860-0697
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DWG NO. / FILE NAME
FLASH1.skd
SCALE
N. T. S.
DATE
9/6/96
SHEET
SEVEN

FLASHING DETAIL @
INSIDE CORNER
CONTRACTOR
JOB #
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SCALE
N. T. S.
DATE
9/6/96
DWG NO. / FILE NAME
FLASH2.skd
SHEET
EIGHT

10'-0"
4"
6"
4"
BASE FLASHING
26 GAUGE HOT
DIPPED G-90
GALV. METAL
CONTRACTOR
JOB #
DESCRIPTION
26 GAUGE GALVANIZED
BASE FLASHING
DRAWN BY
CHRIS CLINGERMAN
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SEPTEMBER 6, 1998
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DWG NO. / FILE NAME
FLASH9.skd
SCALE
N. T. S.
DATE
9/8/96
SHEET
NINE

2-1/2"
3"
3"
10'-0"
2-1/2"
COUNTER FLASHING
26 GAUGE HOT
DIPPED G-90
GALV. METAL
CONTRACTOR
JOB #
DESCRIPTION
26 GAUGE GALVANIZED
COUNTER FLASHING
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SCALE
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DATE
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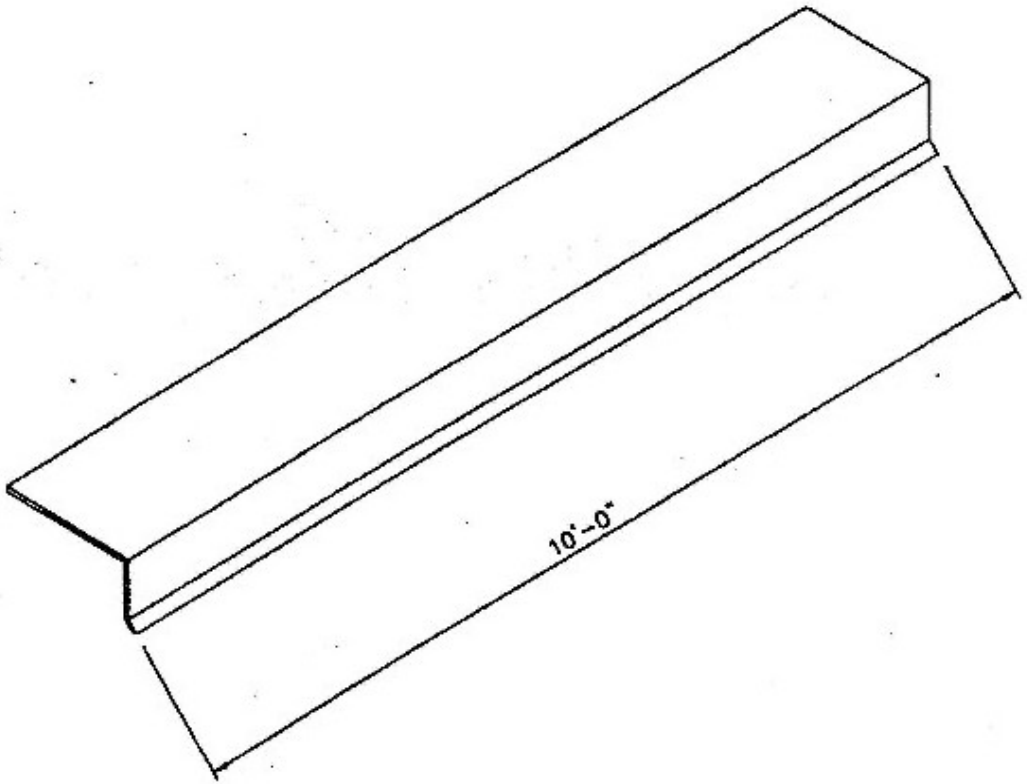
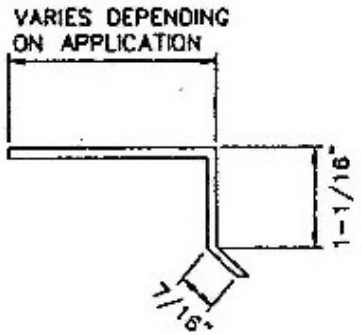
DWG NO. / FILE NAME
FLASH4.skd
SHEET
TEN

071300-15





EAVE FLASHING
26 GAUGE HOT
DIPPED G-90
GALV. METAL

CONTRACTOR	COMPANY	MILLER, MILLER & MAC FL. INC.	
JOB #			
DESCRIPTION: 26 GAUGE GALVANIZED EAVE FLASHING		11310 SATELLITE BLVD. ORLANDO, FL. 32837	
DRAWN BY: CHRIS CLINGERMAN		OFFICE (407)860-0697 FAX (407)851-5886	DWG NO. / FILE NAME: FLASH5.skd
REVISED: SEPTEMBER 11, 1996	SCALE: N. T. S.	DATE: 9/11/96	SHEET: ELEVEN

TYPICAL LAP DETAILS
LAP SEALANT
60 MILLIMETER ELASTOMERIC WATERPROOFING MEMBRANE
4" (MIN.)
END LAP
60 MILLIMETER ELASTOMERIC WATERPROOFING MEMBRANE
LAP SEALANT
60 MILLIMETER ELASTOMERIC WATERPROOFING MEMBRANE
3" (MIN.)
SIDE LAP
CONTRACTOR
JOB #
DESCRIPTION
H2O LAP DETAIL
DRAWN BY
CHRIS CLINGERMAN
REVISED
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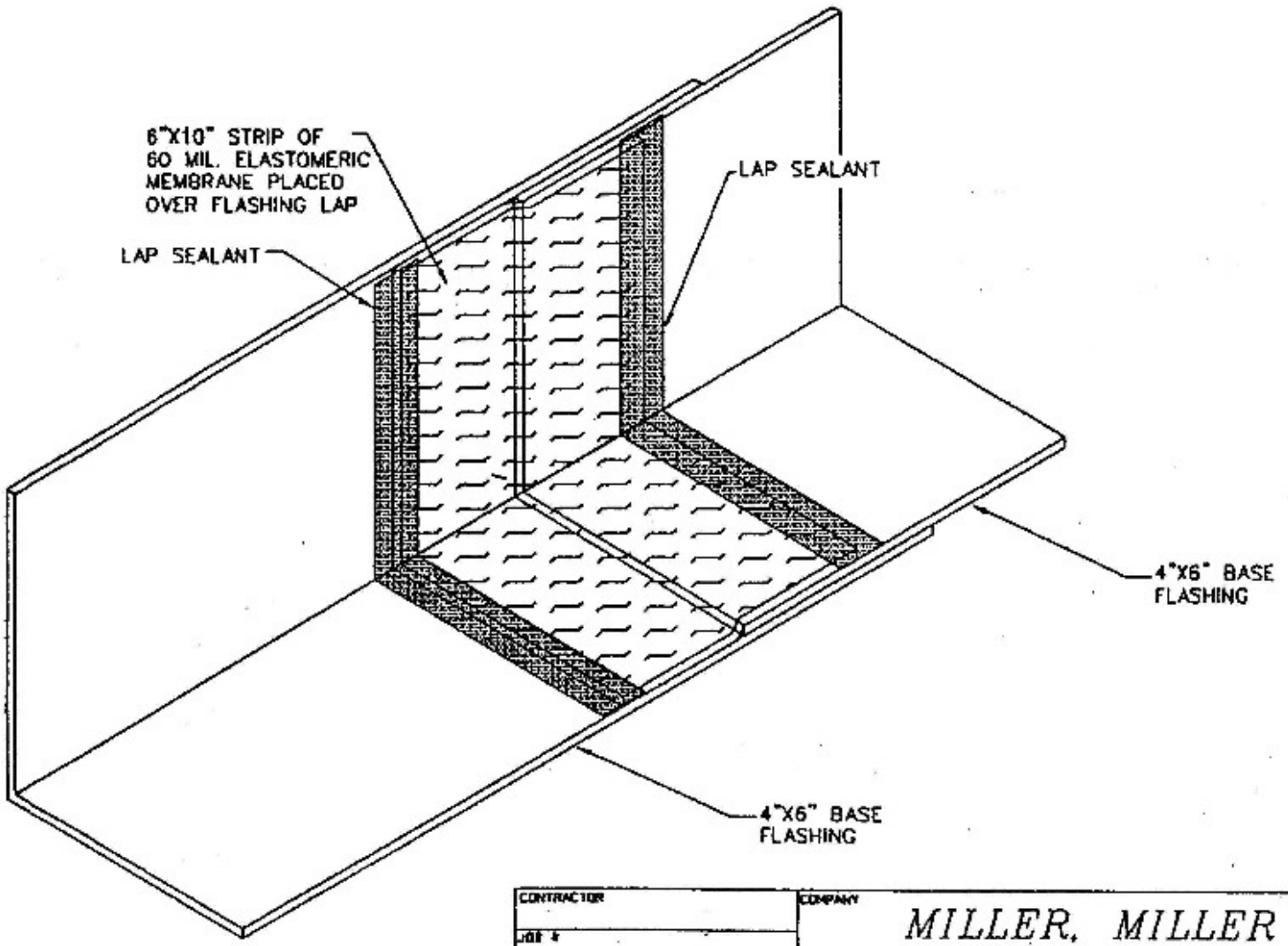
DWG NO. / FILE NAME
SPLICE.skd
SCALE
N. T. S.
DATE
9/11/96
SHEET
TWELVE



CONDITION @ METAL
FLASHING LAP

CONTRACTOR	COMPANY: MILLER, MILLER & MAC FL. INC.
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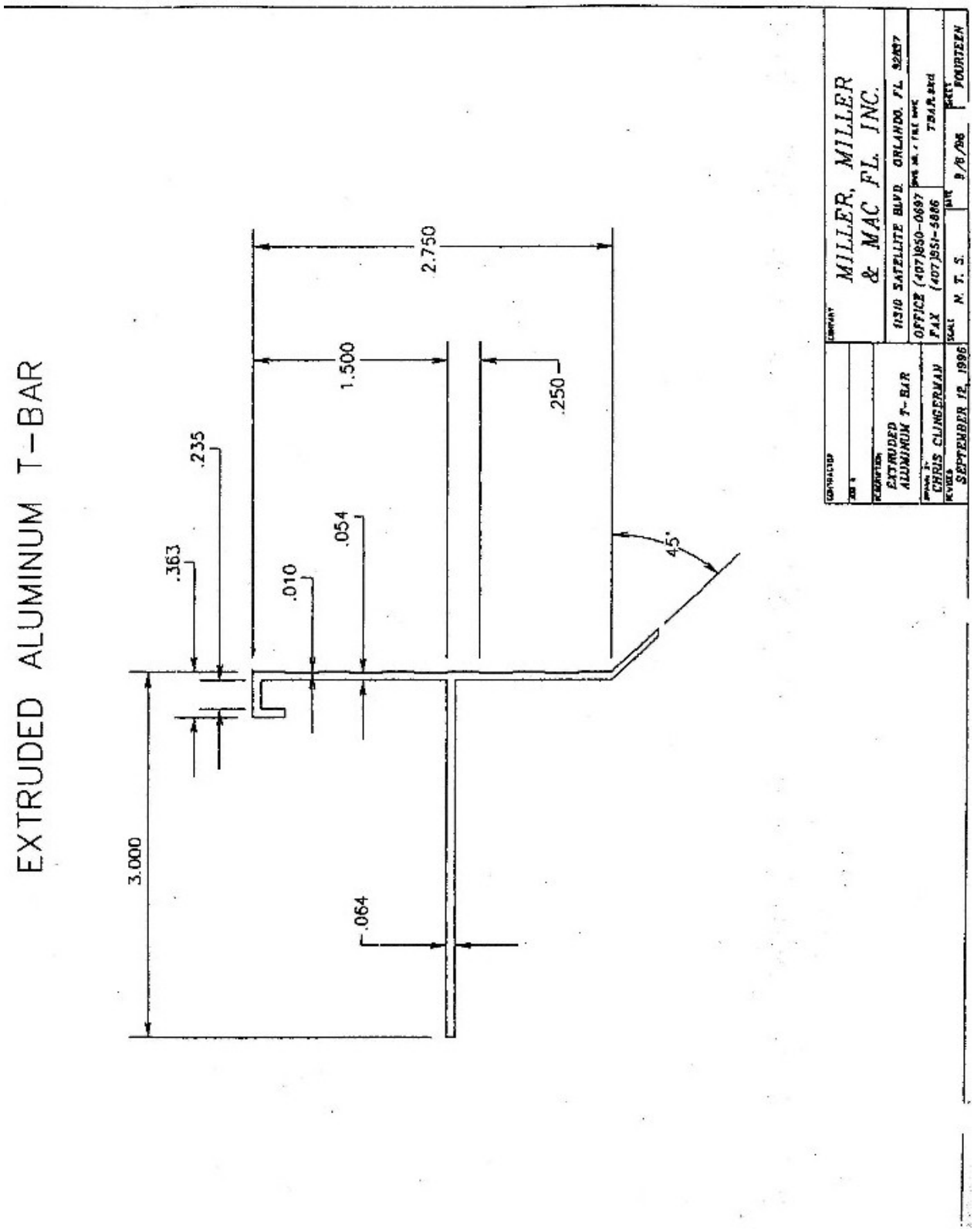
REVISED: SEPTEMBER 12, 1996	DWG NO. / FILE NAME: METALAP.skd
SCALE: N. T. S.	DATE: 9/12/96
SHEET: THIRTEEN	



END OF SECTION 07110

SECTION 071326

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to, the following:
   1. Rubberized asphalt sheet membrane waterproofing system.
   2. Prefabricated drainage composite.
   3. Protection board.

B. Related Sections: Other specification sections which directly relate to work of this Section include, but are not limited to, the following:
   1. 03 30 00 – Cast-In-Place Concrete
   2. 07 60 00 – Flashing and Sheet Metal
   3. 07 92 00 – Joint Sealants
   4. 07 95 00 – Expansion Control
   5. 33 46 00 – Subdrainage

1.2 REFERENCE STANDARDS

A. The following standards and publications are applicable to the extent referenced in the text.

B. American Society for Testing and Materials (ASTM)
   1. C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
   2. D 412 Standard Test Methods for Rubber Properties in Tension
   3. D 570 Standard Test Method for Water Absorption of Plastics
   4. D 882 Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
   5. D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
   6. D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel)
   7. D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
   8. D 3767 Standard Practice for Rubber - Measurements of Dimensions
   9. D 5385 Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
   10. E 96 Standard Test Methods for Water Vapor Transmission of Materials
   11. E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

1.3 SUBMITTALS

A. Product Data: For each type of product, submit manufacturer's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: Submit representative samples of the following for approval:
   1. Sheet membrane

2. Protection board
3. Prefabricated drainage composite
4. Sample Warranties

1.4 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer: A firm which has at least 3 years experience in work of the type required by this section.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
   1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
   2. Protect mastic and adhesive from moisture and potential sources of ignition.
   3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
   4. Protect surface conditioner from freezing.

B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.6 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.7 WARRANTY

A. Sheet Membrane Waterproofing: Provide written 5 year material warranty issued by the membrane manufacturer upon completion of the work.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet Waterproofing System: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Grace, W. R., & Co. - Conn.; Bituthene 4000.
      b. American Hydrotech, Inc.; VM75.
      c. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
      d. CETCO Building Materials Group, a subsidiary of AMCOL International Corp.; Envirosheet.
      e. Henry Company; Blueskin WP 100/200.
      f. Meadows, W. R., Inc.; SealTight Mel-Rol.
      g. Nervastral, Inc.; BITU-MEM.
      h. Polyguard Products, Inc.; Polyguard 650.
      i. Protecto Wrap Company; PW 100/60.
      j. Tamko Building Products, Inc.; TW-60.
      k. York Manufacturing, Inc.; HydroGard.
   2. Physical Properties:
      a. Thickness: 60 mil; ASTM D 3767 Method A.
      b. Tensile Strength, Membrane: 250-psi minimum; ASTM D 412, Die C, modified. Film: 34.5 MPa; ASTM D 882.
      c. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
      d. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
      e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
      f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
      g. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
      h. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
      i. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.
      j. Lap Adhesion: 880 lbs/in.; ASTM D 1867.
      k. Peel Strength: 9 lbs/in.; ASTM D 903.

B. Protection Board:
   1. Expanded Polystyrene Protection Board: 25 mm thick for vertical applications with the following characteristics. Adhere to waterproofing membrane with Bituthene Protection Board Adhesive.
      a. Normal Density: 1.0 lb/ft^3
      b. Thermal Conductivity, K factor: 0.24 at 40°F, 0.26 at 75°F
      c. Thermal Resistance, R-Value: 4 per 1 in. of thickness.
   2. Asphalt Hardboard: A premolded semi-rigid protection board consisting of bitumen, mineral core and reinforcement. Provide 0.125 in. thick hardboard on horizontal surfaces not receiving steel reinforced slab. Where steel reinforcing bars are to be used, apply two layers of 0.125 in. thick hardboard or one layer of 0.25 in. thick hardboard.

C. Waterstop: Adcor™ ES hydrophilic non-bentonite waterstop by Grace Construction Products for non-moving concrete construction joints.

D. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATES

A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.

B. Cast-In-Place Concrete Substrates:
1. Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete). If time is critical Bituthene® Primer B2 may be used to allow priming and installation of membrane sooner than 7 days. Priming may begin in this case as soon as the concrete will maintain structural integrity.
2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
3. Repair bugholes over 0.5 in. in length and 0.25 in. deep and finish flush with surrounding surface.
4. Remove scaling to sound, unaffected concrete and repair exposed area.
5. Grind irregular construction joints to suitable flush surface.

C. Masonry Substrates: Apply waterproofing over concrete block and brick with smooth trowel-cut mortar joints or parge coat.

D. Wood Substrates: Apply waterproofing membrane over securely fastened sound surface. All joints and fasteners shall be flush to create a smooth surface.

E. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.3 INSTALLATION

A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:
1. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.

2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.
3. Seal daily terminations with troweled bead of mastic.
4. Apply protection board and related materials in accordance with manufacturer's recommendations.

3.4 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 072101

BATT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Batt insulation and vapor retarder in exterior frame wall, ceiling and roof construction, and filling crevices in exterior wall and roof.

B. Related Sections:

1. Section 01300 – Submittals
2. Section 01400 – Quality Requirements
3. Section 07180 - Air and Vapor Barriers
4. Section 09250 – Gypsum Board

1.2 REFERENCES

A. ASTM C 665 – Mineral Fiber Blanket Thermal Insulation for Wood Frame and Light Construction Buildings.

1.3 SYSTEM DESCRIPTION

A. Materials of this section shall provide a thermal and vapor retarder at building enclosure elements.

1.4 SUBMITTALS

A. Product Data:

1. Product data for each batt insulation product utilized and any associated accessories.

B. Test Reports:

1. Furnish reports from and based on testing performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements

C. Research Reports:

1. Furnish evaluation reports of the model code organization acceptable to authorities having jurisdiction, that evidence of compliance of foam-plastic insulation with the current building code in effect for this Project is acceptable.

1.5 QUALITY ASSURANCE

A. Supplier:

1. Single Source Responsibility for Insulation Products: Obtain each type of board insulation product and associated accessories from a single source with resources to provide products complying with requirements indicated without delaying Work.

B. Fire-Test Response Characteristics:

1. Provide insulation and related materials with the fire-test-response characteristics that are shown on the drawings or listed elsewhere in these Specifications, as determined by

testing identical products per test method indicated below, by U.L. or another acceptable testing agency. Identify materials with appropriate markings of applicable testing and inspecting agency:

a. ASTM E 84 – Surface Burning Characteristics
b. ASTM E 119 – Fire-Resistance Ratings
c. ASTM E 136 – Combustion Characteristics

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. CertainTeed Corporation.

B. Owens-Corning Fiberglas Corporation.

C. Schuller International, Inc.

D. Substitutions: To requirements of Division 1.

2.2 MATERIALS

A. Batt Insulation: ASTM C665, Type I, preformed mineral fibre batt blankets; without membrane.

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

B. Batt Insulation: ASTM C665, Type II, Class C, preformed mineral fibre batt blankets; unfaced for all “non thermal” conditions but with Kraft vapor barrier on one side and stapling flanges at exterior walls.

1. Mineral Fiber Type: Fibers manufactured from glass.

C. Vapor Retarder: Translucent polyethylene film, 6 mil thick. (at attic location only)

D. Nails or Staples: Steel wire; galvanized.

E. Tape: Pressure sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

F. All batt insulation to be treated with poly-seal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site conditions are ready to receive work.

B. Beginning of installation means acceptance of site conditions.

3.2 INSTALLATION

A. Comply with insulation manufacturers written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry and unsoiled.

C. Extend insulation in thickness indicated to envelope entire area to be insulated.

D. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Install batt insulation, vapor retarder in exterior walls, roof, and between ceiling framing spaces without gaps or voids. Refer Drawings for locations not described in this Section.

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 in place.

F. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

G. Install with factory applied membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

H. Place vapor retarder so that it is on the warm side of the insulation.

I. Extend vapor retarder and air barrier tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place. Coordinate vapor retarder and air seal sections.

1. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesive or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose fiber insulation.
2. Seal vertical joints in vapor retarders over framing by lapping not less than two (2) wall studs. Fasten vapor retarders to framing at top, end and bottom edges, at perimeters of wall openings and at lap joints. Space fasteners at 16” o.c.
3. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives, as recommended by vapor retarder manufacturer.
4. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with vapor retarder tape to create an airtight seal between penetrating objects and vapor retarder.
5. Repair any tears or punctures in vapor retarder immediately before concealment by other work. Cover with vapor retarder tape or another layer of vapor retarder.

3.3 PROTECTION of WORK

A. 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.

3.4 SCHEDULE for BATT INSULATION

A. Provide batt insulation in the following locations and with the associated R-values:
- Roof/Ceilings – R38 batt fiberglass insulation (in areas which cannot be blown)
- Floor/Ceilings – R38 batt fiberglass attached to top of truss cavity where floor ceiling assemblies occur over unconditioned areas.
- Floor/Ceilings – R19 batt fiberglass insulation attached to top of truss cavity where floor ceiling assemblies occur between conditioned areas.
- Airchutes – One baffle every truss space

- Exterior walls – R-13 fiberglass batt in 2x4 Walls, R-19 Fiberglass Batt in 2x6 Walls
- Corridor walls – R-13 fiberglass batt in 2x4 Walls, R-19 Fiberglass Batt in 2x6 Walls
- Rim area – R-13 or R-19 fiberglass insulation (per wall size above)
- Provide R-11 Sound Insulation at walls surrounding Baths and Laundry as indicated
- Provide R-11 Sound Insulation in both wall cavities at all tenant separation walls.

END OF SECTION

SECTION 072102

BLOWN INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceiling and Attic: Provide Grade I R-38 Blown Insulation - Install Loose insulation pneumatically placed through access holes.

B. Related Sections:

1. Section 01300 – Submittals
2. Section 01400 – Quality Assurance
3. Section 09260 – Gypsum Board Assemblies

1.2 REFERENCES

A. ASTM C 764 – Mineral Fiber Loose Fill Insulation

1.3 PERFORMANCE REQUIREMENTS

A. Materials of this section shall provide continuity of thermal barrier at building enclosure elements.

1.4 SUBMITTALS

A. Product Data:

1. Provide product data on product characteristics, performance criteria and limitations

B. Test Reports:

1. Furnish reports from and based on testing performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements.

C. Manufacturer's Installation Instructions:

1. Indicate procedure for preparation and installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - INSULATION MATERIALS

A. CertainTeed Corporation.

B. Owens Corning Corporation

C. Substitutions: To requirements of Division 1.

2.2 MATERIALS

A. Fibre Fill Insulation: ASTM C764, glass fiber type, bulk for pneumatic placement, R value of 4.0 per inch of thickness.

B. Vapor Retarder: Translucent polyethylene film, 6 mil thick.

C. Nails or Staples: Steel wire; galvanized.

D. Tape: Pressure sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder

E. Ventilation Baffles: Formed plastic.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that light fixtures have thermal cut-out device to restrict over heating in soffit or ceiling spaces.

B. Verify spaces are unobstructed to allow placement of insulation.

3.2 INSTALLATION

A. Install insulation and ventilation baffle to manufacturer's instructions and to Grade I standards.

B. Pneumatically place insulation tight in attic spaces between joists.

C. Place insulation against baffles. Do not impede natural attic ventilation to soffit.

D. Place tight to and behind mechanical and electrical services within the plane of insulation.

E. Completely fill intended spaces. Leave no gaps or voids.

3.2 SCHEDULES

A. Attic Spaces: Pneumatically place insulation in thickness between ceiling joists to achieve a minimum R value of 49 or minimum to comply with State of Virginia adopted Energy Code.

END OF SECTION

SECTION 07 25 00

OSB WEATHER-RESISTANT BARRIER (WRB) AND AIR BARRIER (AB) SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work of this section includes OSB panel with integral weather-resistant barrier (WRB) and air barrier (AB) features, and all accessory materials required for sealing sheathing joints, penetrations, rough openings, and material transitions, for use under exterior wall claddings

1.2 RELATED SECTIONS

A. [Section 014000 Quality Requirements;] [Section 014529 Testing Laboratory Services;] [Section 014533 Code-Required Special Inspections and Procedures;] coordination with owners' independent testing and inspection agency

B. Section 014339 Mock-Ups; exterior wall mock-ups.

C. Section 054000 Cold-Formed Metal Framing

D. Section 061000 Rough Carpentry

E. Section 076500 Flexible (Through-Wall) Flashing

F. Section 079200 Joint Sealants, sealant materials, and installation techniques

G. Exterior wall claddings

1.3 DEFINITIONS

A. Air Barrier(AB): Air tight barrier made of material that is relatively air impermeable but moisture vapor permeable, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces

B. Weather-Resistant Barrier (WRB): Water-shedding barrier made of material that is moisture-resistant, installed to shed water, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

C. Rough Openings: Openings in the wall to accommodate windows and doors.

D. Material Transitions: Areas where the OSB WRB/AB sheathing connects to slabs, parapets, foundation walls, roofing systems, and at the interface of dissimilar materials.

1.4 REFERENCE STANDARDS

A. ASTM International (ASTM): www.astm.org
   1. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials
   2. ASTM D3330-Standard Test Method for Peel Adhesion of Pressure-Sensitive Tape
   3. ASTM D5651-Standard Test Method for Surface Bond Strength of Wood-Base Fiber and Particle Panel Materials

4. ASTM D2247-Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
5. ASTM E331-Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
6. ASTM E1233-Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Cyclic Air Pressure Differential
7. ASTM E72-Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
8. ASTM E84- Standard Test Method for Surface Burning Characteristics of Building Materials
9. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

B. American Architectural Manufacturers Association (AAMA)
1. AAMA 711 Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products

C. Pressure Sensitive Tape Council (PSTC)
1. PSTC 101 Peel Adhesion of Pressure Sensitive Tapes
2. PSTC 131 Breaking Strength and Elongation of Pressure Sensitive Tapes

D. US Department of Commerce (DOC): http://gsi.nist.gov/global/index.cfm/L1-5/l2-44/A-355
1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels

E. International Code Council (ICC): www.iccsafe.org
1. ICC IBC - International Building Code
2. ICC IRC - International Residential Code for One- and Two-Family Dwellings

F. ICC Evaluation Service, Inc. (ICC-ES): www.icc-es.org
1. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers

G. Sustainable Forestry Initiative (SFI): www.sfiprogram.org/
1. SFI 2010 - 2014 Standard

1.5 SUBMITTALS

A. Submittals; Submit in accordance with Division 1 requirements

B. Product Data and Installation Instructions: Submit manufacturer's product data including sheathing and accessory material types, composition, descriptions and properties, installation instructions and substrate preparation recommendations.

C. Shop Drawings: Submit shop drawings indicating locations and extent of WRB/AB system, including details of typical conditions, special joint conditions, intersections, with other building envelope systems and materials: counterflashings and details showing bridging of envelope at substrate changes, details of sealing penetrations, and detailed flashing around windows and doors.

D. Test Reports: Submit test reports indicating compliance with specific performance characteristics and requirements.

E. Sample Warranty: Submit a sample warranty identifying the terms and conditions of the warranty as herein specified.

F. APA Product Report PR-N136: For WRB/AB system from APA The Engineered Wood Association

G. Florida Product Approval APA Product Report PR-N136F.

1.6 WARRANTY

A. Residential projects: Provide manufacturer's standard warranty that offers a lifetime limited warranty to the original home owner of a structure using ForceField OSB wall panels.

B. Commercial projects: Provide manufacturer's standard two-year transferable limited warranty to the owner of a structure using ForceField OSB wall panels.

1.7 QUALITY ASSURANCE

A. Install WRB/AB sheathing with sealed joints and penetrations in mock -up as specified in [Section 014339 Mock-Ups] [Section_____]

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.

1.9 FIELD CONDITIONS

A. Ensure ForceField OSB sheathing surface is free from moisture, dirt, and other debris before the application of tape

B. Do not install tape in temperatures less than 20 degrees F or if panel surface has frost or ice.

PART 2 - PRODUCTS

2.1 WEATHER BARRIER ASSEMBLIES

A. Acceptable product: ForceField Weather-Resistive Barrier OSB as manufactured by Georgia-Pacific Wood Products LLC. www.gpforcefield.com

B. Single Source Limitations: Provide wall sheathing/weather barrier by a single manufacturer.
1. Sheathing: ForceField Weather-Resistive Barrier OSB
2. Tapes and flashing materials:
   a. GP ForceField Tape, minimum 3" wide and 0.009 inch thick.
   b. Georgia-Pacific Flashing Tape, minimum 4" wide and 0.012 inch thick.
3. Fasteners, backer rods, and accessory materials: As approved by Georgia-Pacific Wood Products LLC

C. System description: Air and water-resistive barrier system installed at exterior stud walls under exterior cladding, consisting of the following components as herein specified:
1. Sheathing: ForceField Weather-Resistive Barrier OSB
2. Self-adhered tape: GP ForceField Tape to seal sheathing joints, inside and outside corners, and penetrations.
3. Self-adhered flashing tape: Georgia-Pacific Flashing Tape to seal rough openings and material transitions.
4. Fasteners and backer-rods as required by system manufacturer's instructions.

2.2 WEATHER-RESISTANT BARRIER (WRB) AND AIR BARRIER (AB) OSB SHEATHING

A. Description: OSB panel with integral weather-resistant barrier(WRB) and air barrier (AB) complying with applicable requirements of ICC-ES AC 310, ASTM D5651, ASTM E2357

B. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

C. Oriented Strand Board Wall Sheathing: APA Rated Exposure 1 sheathing

D. OSB Span Rating, Panel Grade and Performance Category: Not less than 24/16 span rating; APA Rated Sheathing; 7/16 Performance Category

E. Edge Profile: Square edge

F. Certified Wood: Provide sheathing produced from wood obtained from forests certified by an accredited certification body.

G. Air-Barrier performance requirement:
1. Air Leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E2357.

H. Water-Vapor Permeance, Panel: Minimum 1.3 perms (689 ng/Pa x s x sq. m), ASTM E96/E96M.

I. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 90 days.

2.3 TAPE/FLASHING FOR JOINTS, INSIDE AND OUTSIDE CORNERS, ROUGH OPENINGS, AND MATERIAL TRANSITIONS

A. Seal panel joints, inside and outside corners, penetrations using self-adhering tape
1. Tape: 3” sheet type self-adhering
2. Properties
a. Material: acrylic
b. Acceptable substrate: ForceField Weather-Resistive Barrier OSB
c. Adhesion to substrate: No delamination from face of sheathing
d. Tape thickness: 0.009 inch
e. Air permeance: meets 0.004 cubic feet per minute per square foot (0.02L/s/sq m), maximum, when tested in accordance with ASTM E2178
f. Water-Vapor Permeance: < 1 perms (ng/Pa x s x sq. m), ASTM E96/E96M.
g. Ultraviolet and weathering resistance: Approved for a minimum of 90 days weather exposure
h. Complies with applicable requirements of Pressure Sensitive Tape Council (PSTC)

B. Seal window/door rough openings and material transitions using self-adhering flashing
1. Flashing material: 4” sheet-type, self-adhering
2. Properties:
a. Material: butyl based
b. Acceptable substrate: ForceField Weather-Resistive Barrier OSB
c. Adhesion to substrate: No delamination from face of sheathing
d. Tape thickness: 0.012 inch
e. Air permeance: meets 0.004 cubic feet per minute per square foot (0.02L/s/sq m), maximum, when tested in accordance with ASTM E2178
f. Water-Vapor Permeance: < 1 perms (ng/Pa x s x sq. m), ASTM E96/E96M.
g. Ultraviolet and weathering resistance: Approved for a minimum of 90 days weather exposure

h. Complies with applicable requirements of AAMA 711

2.4 FASTENERS

A. Fasteners, General: Corrosion-resistant, size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.

B. Nails, Brads, and Staples: ICC AC116 and ICC AC201, corrosion-resistant.

C. Power-Driven Fasteners: ICC-ES-1539 or NER-272, corrosion-resistant.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

B. Remove projections, protruding fasteners, loose or damaged sheathing material at edges of panel that might interfere with proper installation to seal joints, corners, penetrations, openings, or material transitions.

C. Wipe down the sheathing surface to receive sealing materials with a clean cloth.

D. Ensure field conditions are met as outlined in Part 1-General Requirements

3.2 INSTALLATION OF WEATHER RESISTANT BARRIER (WRB) AND AIR BARRIER (AB) SHEATHING

A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Product Report, and requirements of authorities having jurisdiction.

B. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant sequencing and installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.

C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.

D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs. Support all panel edges.
1. Space square-edged panels with a 0.125 inch (3 mm) gap between board ends and edges, to allow for expansion and contraction.

E. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:
1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
2. IBC: Table 2304.9.1 Fastening Schedule.
3. IRC: Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments."

3.3 INSTALLATION OF SELF-ADHERED TAPE/FLASHING FOR SEALING SHEATHING JOINTS, CORNERS, PENETRATIONS, ROUGH OPENINGS, AND MATERIAL TRANSITIONS

A. Apply 3” GP ForceField Tape at all panel seams, corners, and facer defects or cracks to form continuous water and air resistant surface. Apply tape according to manufacturer's written instructions.

1. Align and position self-adhering ForceField tape over the joint. Press the tape firmly onto the joint. Ensure there is at least 1" tape coverage on either side of the joint.
2. On horizontal joints or vertical splices, ensure the tape overlaps at least 2"at all ends of the tape. At T-joints, tape should overlap by at least 1".
3. Ensure the above taped section is overlapping the lower tape section so that all overlaps are shingle style.
4. Press taped joints and overlaps with your hand to ensure a tight seal.

B. Apply 3" GP ForceField Tape to seal exterior wall penetrations. Apply tape according to manufacturer's written instructions.
1. Fill gap around penetration with a backer rod to support the tape around the penetration.
2. Align and position tape on bottom side of penetration and press firmly into place.
3. Align and position tape on both sides of the penetration as close to the penetration as possible and press firmly into place.
4. Ensure the above taped section is overlapping the lower tape section so that all overlaps are shingle style.
5. Align and position tape on top of the penetration as close to the penetration as possible and press firmly into place.
6. Press taped joints and overlaps with your hand to ensure a tight seal to the panel.

C. Apply 4" Georgia-Pacific Flashing Tape at window/door rough openings. Apply flashing according to manufacturer's written instructions.
1. Cut two pieces from the 4" tape and install one into each sill-jamb corner. Cut the two pieces long enough to so the tape can be folded onto the panel face approximately 2". The tape will not be smooth because of the fit into the corners and the fold onto the panel.
2. Align and position the tape over the sill. Remove release paper and press firmly into place.
3. Install tape over sill. The tape should fold down approximately 2" onto the sheathing. Slice tape to extend tape a minimum 3"onto the panel surface (and over tape applied in step 1) and minimum 3" up the jambs.
4. Optional for flanged windows: For flashing the two jambs of the opening, repeat step 3 so both jambs are flashed and tape extends minimum 2" onto the panel. Slice tape so that the tape on the panel extends 1" above the top of the opening. Fold the 1" sliced piece to the bottom of the header.
5. Optional for flanged windows: Repeat step 3 over the header portion of the opening. Slice tape so the header frame is flashed and extends minimum 2" onto the panel above the opening and 3" down the jambs or sides of the opening.
6. Ensure the above taped section is overlapping the lower tape section so that all overlaps are shingle style.
7. Press taped joints and overlaps with your hand ensure a tight seal to the panel and opening

D. Apply 4" Georgia-Pacific Flashing Tape at material transitions. Apply flashing according to manufacturer's written instructions.
1. If necessary, fill transition gap between the two different substrates with a backer rod if gap is over 1/8" wide to support the flashing at the transition joint.
2. Align and position flashing, and press firmly into place. Ensure minimum 2" of flashing is on each substrate material surface.
3. Ensure minimum 2" overlap at all end laps of flashing
4. Ensure the above flashed section is overlapping the lower tape section so that all overlaps are shingle style.
5. Press taped joints and overlaps with your hand or a J-roller to ensure a tight seal

3.4 FIELD QUALITY CONTROL

A. Do not cover installed ForceField Weather-Resistive Barrier OSB system until required inspections have been completed and installation has been accepted.

B. Where applicable, allow for owner's inspection and air barrier testing and reporting.

3.5 PROTECTION

A. Protect WRB/AB assembly from damage during installation and during the construction period

END OF SECTION

SECTION 072605

UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 – GENERAL

1.1 SUMMARY

A. Products Supplied Under This Section

1. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

B. RELATED SECTIONS

1. Section 03300 Cast-in-place Structural Concrete
2. Section 07260 Under-Slab Vapor Retarder

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM E 1745-97 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil
   or Granular Fill Under Concrete Slabs
2. ASTM E 154-88 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
3. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials
4. ASTM E 1643-98 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

B. American Concrete Institute (ACI)

1. ACI 302.1R-96 Vapor Barrier Component (plastic membrane) is not less than 10 mils thick

1.3 SUBMITTALS

A. Quality Control / Assurance

1. Independent laboratory test results showing compliance with ASTM & ACI Standards.
2. Manufacturer's samples, literature
3. Manufacturer's installation instructions for placement, seaming and pipe boot installation

PART 2 – PRODUCTS

2.1 MATERIALS

A A. Vapor Barrier

B 1. Vapor Barrier must have the following qualities

a. WVTR less than 0.008 as tested by ASTM E 96
b. ASTM E 1745 Class A (Plastics)
c. Approved for use as a Radon barrier

2. Vapor Barrier Products

a. Stego Wrap (10 mil) Vapor Barrier by STEGO INDUSTRIES LLC, San Juan Capistrano, CA (877) 464-7834
b. Perminator (10mil) by W.R. Meadows
c. Viper – CS (10 mil) by Insulation Solutions, Inc., East Peoria, IL 61611, Tel (866) 698-6562

B. ALTERNATE VAPOR BARRIER

1. Provide alternate Price for 15 mil Moistop Ultra 15 vapor barrier and associated Fortifiber Accessories

2.2 ACCESSORIES

A. Seam Tape

1. Tape must have the following qualities:
   a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower

2. Seam Tape
   a. Provide compatible accessory seam tape from vapor barrier supplier/mfr

B. Vapor Proofing Mastic
   1. Mastic must have the following qualities:
      a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lowe
   2. Mastic
      b. Provide compatible accessory mastic from vapor barrier supplier/mfr

C. Pipe Boots
   1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by architect or geotechnical firm
   1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier/Retarder:
   1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.
      a. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
      b. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
      c. Overlap joints 6 inches and seal with manufacturer's tape.
      d. Seal all penetrations (including pipes) per manufacturer's instructions.
      e. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.
      f. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION

SECTION 074646

CEMENTITIOUS PLANK SIDING AND TRIM MATERIAL

PART 1 - GENERAL

A. Work under this section is subject to the provisions of the contract documents which in any way affect the work specified herein.

1.1 SCOPE

A. Furnish and install Prevail Cementitious Plank and Cementitious Panel fiber-cement siding, Cementitious Trim fascia and moulding and accessories where shown on drawings or as specified herein.
B. Coordinate this section with interfacing and adjoining work for proper sequence of installation.
C. Work in other sections affecting this work.
    1. Section 6100 Rough Framing
    2. Section 9900 Painting

1.2 QUALITY ASSURANCE

A. Submittals: within sixty (60) days of owner's notice
    1. Submit three 6 inch x 6 inch pieces of Cementitious Plank / Cementitious Panel claddings in texture and widths shown and specified herein.
    2. Submit three copies of specifications, installation data and other pertinent manufacturer's literature.

1.3 PRODUCT HANDLING

A. Stack Cementitious Plank / Cementitious Panel claddings on edge or lay flat on a smooth, level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

1.4 JOB CONDITIONS

A. Nominal 2 x wood framing selected for minimal shrinkage and complying with local building codes, including the use of weather-resistive barriers and/or vapor barriers where required. Minimum 1½ inch face and straight, true, of uniform dimensions and properly aligned.
B. Install weather-resistive barriers and claddings to dry surfaces.
C. Repair any punctures or tears in the weather-resistive barrier prior to the installation of the siding.
D. Protect siding from other trades.
   And (In commercial areas)
    1. Minimum 20 gauge 35/8 inch C-Stud 16 inch maximum on center or 16 gauge 35/8 inch C-Stud 24 inch maximum on center metal framing complying with local building codes, including the use of weather-resistive barriers and/or vapor barriers where required. Minimum 1½ inch face and straight, true, of uniform dimensions and properly aligned.
    2. Install weather-resistive barriers and claddings to dry surfaces.
    3. Repair any punctures or tears in the weather-resistive barrier prior to the installation of the siding.
    4. Protect siding from other trades.

1.5 WARRANTY

A. Provide limited product warranty against manufacturing defects in Cementitious Plank lap and Cementitious Panel vertical siding for 50 years, and Cementitious Trim for 10 years..
B. Workmanship: application limited warranty for 2 years.

PART 2 - PRODUCTS

2.1 CEMENTITIOUS PLANK / CEMENTITIOUS PANEL / CEMENTITIOUS TRIM FASCIA AND MOULDING BY SINGLE SUPPLIER

- James Hardie
- Allura
- Others as approved by the Architect/Owner/Contractor and submitted in accordance with the requirements of Section 1300

A. Non-asbestos fiber-cement siding to comply with ASTM Standard Specification C1186 Grade II, Type A.

B. Siding to meet the following building code compliance National Evaluation Report No. NER 405 (BOCA, ICBO, SBCCI);US Department of Housing and Urban Development Materials Release 1263a; Non-asbestos fiber-cement siding to be non-combustible when tested in accordance with ASTM test method E136.

C. Plank Siding Type: (Wood Grain 6¼" W / 5" EXP), (Woodgrain 9½" W / 8¼" EXP)

D. Panel Siding Type: (Smooth Vertical siding panel 4' x 10')

E. Trim Type: 1" x (size indicated on the window, door, and trim detailing)

2.2 FASTENERS

A. Wood framing: 0.091" shank x 0.225" head x 2" corrosion resistant siding nails.

B. Metal framing: 1 ¼" No. 8-18 x 0.375" head self-drilling, corrosion resistant S-12 ribbed buglehead screws.

C. Concrete Walls: Erico Stud Nail, ET&F ASM No.-144-125, 0.14" shank x 0.30" head x 2" corrosion resistant nail.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Correct conditions detrimental to timely and proper completion of work.

3.2 INSTALLATION - CEMENTITIOUS TRIM FASCIA AND MOULDING

A. Install all material in strict accordance with all manufacturer's written instructions

B. Install flashing around all wall openings.

C. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum ¾ inch or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.

D. Place fasteners no closer than ¾ inch and no further than 2 inch from side edge of trim board and no closer than 1 inch from end. Fasten maximum 16 inch on center.

E. Maintain clearance between trim and adjacent finished grade.

F. Trim inside corner with single board.

G. Install single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Cementitious Trim board to Cementitious Trim board.

H. Allow 1/8 inch gap between trim and siding.

I. Seal gap with high quality, paint-able caulk.

J. Shim frieze board as required to align with corner trim.

K. Install Cementitious Trim fascia over structural subfascia.

3.3 INSTALLATION - CEMENTITIOUS PLANK SIDING

A. Install all material in strict accordance with all manufacturer's written instructions

B. Starting: Install a minimum ¼ inch thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1¼ inch wide laps at the top. The bottom edge of the first plank overlaps the starter strip.

C. Allow minimum 1 inch vertical clearance between roofing and bottom edge of siding.

D. Align vertical joints of the planks over framing members.

E. Maintain clearance between siding and adjacent finished grade.

F. Locate splices at least one stud cavity away from window and door openings.

G. Use off-stud metal joiner when vertical joints occur between framing members. Position metal joiner so that the bottom lip is resting on the solid course of planks. Fasten plank to the framing. Position and fasten abutting plank into place insuring that the lower edges of the two planks align. Locate metal joiner centrally behind the joint. Locate off-stud splices a minimum of two stud cavities from wall corners and stagger all subsequent course splices at minimum 24 inch intervals when located in the same wall cavity.

H. Wind Resistance: Where a specified level of wind resistance is required Cementitious Plank lap

siding is installed to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405.

3.4 INSTALLATION - CEMENTITIOUS PANEL SIDING

A. Install all material in strict accordance with all manufacturer's written instructions
B. Provide Furring for Rainscreen behind all panel locations per manufacturer's written instructions.
C. Block framing between studs where Cementitious Panel siding horizontal joints occur.
D. Place fasteners no closer than 3/8 inch from panel edges and 2 inch from panel corners.
E. Allow minimum 1 inch vertical clearance between roofing and bottom edge of siding.
F. Maintain clearance between siding and adjacent finished grade.
G. Specific framing and fastener requirements refer to Tables 2 and 3 in National Evaluation Service Report No. NER-405.

3.5 FINISHING

A. Finish unprimed siding with minimum one coat high quality, alkali-resistant primer and one coat of either 100% acrylic or latex or oil based, exterior grade topcoat or two coats high quality, alkali-resistant, 100% acrylic or latex, exterior grade topcoat within 90 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.

END OF SECTION

SECTION 075400

TPO THERMOPLASTIC SINGLE-PLY ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thermoplastic single-ply roofing.

B. Insulation.

1.2 RELATED SECTIONS

A. Section 06100: Rough Carpentry: Roof blocking installation and requirements.

B. Section 07620: Sheet Metal Flashing and Trim: Metal flashing and counter flashing installation and requirements.

C. Section 15430: Plumbing Specialties: roof drains, scuppers, gutters and downspout installation and requirements.

1.3 REFERENCES

A. Factory Mutual (FM Global) - Approval Guide.
   1. Factory Mutual Standard 4470 - Approval Standard for Class 1 Roof Covers.

B. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide (TGFU R1306).

C. American Society for Testing and Materials (ASTM) - Annual Book of ASTM Standards.
   1. ASTM C 208 - Standard Specification for Cellulosic Fiber Insulating Board.
   2. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   3. ASTM C 728 - Standard Specification for Perlite Thermal Insulation Board.
   4. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   5. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
   6. ASTM D 312 - Standard Specification for Asphalt Used in Roofing.
   7. ASTM D 1079 - Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
   8. ASTM D 4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
   9. ASTM D 4434 - Standard Specification for Poly (Vinyl Chloride) Sheet Roofing.

D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet

E. National Roofing Contractors Association (NRCA).

F. American Society of Civil Engineers (ASCE).
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

1.4 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.5 PERFORMANCE REQUIREMENTS

A. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.

B. GAFMC shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

1.6 SUBMITTALS

A. Submit under provisions of Section 01300.

B. [Product Data]: Provide [Product Data] sheets for each type of product indicated in this section.

C. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.

D. Samples: Provide samples of insulations, fasteners, membrane materials and accessories for verification of quality.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: GAFMC shall provide a roofing system that meets or exceeds all criteria listed in this section.

B. Installer Minimum Qualifications:

1. Installer shall be classified as a Master Contractor as defined and certified by GAFMC.

C. Source Limitations: Components listed shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

1.8 PRE-INSTALLATION CONFERENCE

A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, GAFMC representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions, agreements, and open issues and furnish copies of recorded discussions to each attending party. The primary purpose of the meeting is to review foreseeable methods and procedures related to roofing work.

1.9 REGULATORY REQUIREMENTS

A. Work shall be performed in a safe, professional manner, conforming to federal, state and local codes.

B. Exterior Fire Test Exposure: Provide a roofing system achieving a UL Class rating for roof slopes indicated.

1. UL Class B rating.

C. Windstorm Classification: Provide a roofing system which will achieve the following Factory Mutual wind uplift rating, as listed in the current FM Approval Guide.

1. Factory Mutual 1-90.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to the site in original containers, with factory seals intact. Products shall carry either a GAFMC or BMCA label.

B. Store pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.

C. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.

D. Remove manufacturer supplied plastic covers from materials provided with such. Use "breathable" type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.

E. Materials shall be stored above 55 degrees F (12.6 degrees C) a minimum of 24 hours prior to application.

F. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.11 PROJECT CONDITIONS

A. Weather:

1. Proceed with roofing only when existing and forecasted weather conditions permit.
2. Ambient temperatures shall be above 45 degrees F (7.2 degrees C) when applying hot asphalt or water based adhesives.

1.12 WARRANTY

A. Provide manufacturer's standard System Pledge Guarantee with single source coverage and a monetary limitation of one (1) dollar per square foot where the manufacturer agrees to repair or replace components in the roof system, which cause a leak due to failure in materials or workmanship.

1. Duration: Twenty (20) years from the date of completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: GAF Materials Corporation; 1361 Alps Rd., Wayne, NJ 07470. ASD. Toll Free Te1: (800) ROOF-411. Tel: (973) 628-3000. Fax: (973) 628-3451. E-mail: TechnicalQuestions@gaf.com. Web: http:// www.gaf.com.

Firestone Building Products – Ultaply System, 250 W. 96th St, Indianapolis, IN.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 INSULATION **(To form crickets as shown on the roof plans, and at opposing slope roof truss conditions)**

A. Tapered Rigid polyisocyanurate board, with an UltraShield coated glass-fiber facer conforming to or exceeding the requirements of ASTM C 1289 / FS HH-I-1972, EnergyGuard Ultra Polyiso, with the following characteristics:

1. Board Thickness: min Board Thickness 1”
2. Thermal Resistance (LTTR value): 6.0/inch

2.3 INSULATION ACCESSORIES

A. Tapered Edge Strip: Factory fabricated rigid perlite strip cut at angles to provide a smooth transition between differences in elevation. EnergyGuard Tapered Edge Strip, by BMCA. Or Firestone Ultraply tapered edge strip.

2.4 MEMBRANE MATERIALS

A. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.060 inch (1.5 mm) thickness, for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. Each full roll contains approximately 1000 sf (93 sqm) of roofing material, 10 feet by 100 feet (3.1 m by 30.5 m) weighing 322 lb (146 kg) EverGuard TPO 60 mil thermoplastic single-ply roofing membrane by GAFMC. Or Firestone Ultraply membrane.

2.5 FLASHING MATERIALS

A. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.060 inch (1.5 mm) thickness, for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. Each full roll contains approximately 1000 sf (93 sqm) of roofing material, 10 feet by 100 feet (3.1 m by 30.5 m) weighing 322 lb (146 kg) EverGuard TPO 60 mil thermoplastic single-ply roofing membrane by GAFMC. Or Firestone Ultraply flashing.

B.

2.6 BITUMEN

A. Asphalt bitumen: ASTM D 312 Type III & IV.

2.7 ADHESIVES, SEALANTS AND PRIMERS

A. Solvent based liquid, required to protect field cut edges of EverGuard TPO membranes. Applied Directly from a squeeze bottle, EverGuard TPO Cut Edge Sealant, by GAFMC. Or Firestone Ultraply sealants adhesives, and primers.

B.

2.8 ACCESSORIES

A. Mechanical Fasteners

1. DrillTec Standard Screws: Alloy steel fastener with CR-10 coating with a .215 inch (5 mm) diameter thread: Factory Mutual Standard 4470 Approved, #3 Phillips truss head or hex head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the surfaces and site conditions are ready to receive work.

B. Verify that the deck is supported and secured.

C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.

D. Verify that the deck surfaces are dry and free of ice or snow.

E. Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.

3.2 SUBSTRATE PREPARATION

A. Structural Concrete Deck:

1. Minimum deck thickness for structural concrete is 4 inches (102 mm).

2. Only poured in place concrete decks that provide bottom side drying are acceptable.
3. The roof deck shall be properly cured prior to application of the roofing system. Curing agents shall be checked for compatibility with roofing materials. Prior to the installation of the roof assemblies, evaluation of the surface moisture and deck's dryness by the use of ASTM D 4263 or hot bitumen test procedures shall be conducted.
4. The deck shall be smooth, level and cannot be wet or frozen.
5. Treat cracks greater than 1/8 inch (3 mm) in width in accordance with the deck manufacturer's recommendations.
6. Sumps for the roof drains shall be provided in the casting of the deck.
7. When insulation or roofing is to be adhered with hot asphalt, prime the deck with asphalt/concrete primer, ASTM D 41 at the rate of one gallon per 100 square feet (0.4 l/sm). Allow the primer to dry prior to the application of the roofing system.

3.3 INSTALLATION - GENERAL

A. Install GAFMC's EverGuard TPO roofing system according to all current application requirements in addition to those listed in this section.

B. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.

3.4 BITUMEN HANDLING

A. Do not mix different types of asphalt.

B. Do not heat the asphalt to or above its flash point or hold the asphalt at temperatures above the finished blowing temperature for more than 4 hours.

C. Do not keep heated tankers above 325 degrees F (163 degrees C) overnight.

3.5 INSULATION - GENERAL

A. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder shall be repaired.

B. Do not install wet, damaged or warped insulation boards.

C. Install insulation boards with staggered board joints in one direction (unless taping joint).

D. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). All gaps in excess of 1/4 inch (6 mm) shall be filled with like insulation material.

E. Wood nailers shall be 3-1/2 inches (89 mm) minimum width or 1 inch (25 mm) wider than metal flange. They shall be of equal thickness as the insulation with a minimum 1 inch (25 mm) thickness. All nailers shall be securely fastened to the deck.

F. Do not kick insulation boards into place.

G. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.

H. Insulation shall not be installed over new lightweight insulating concrete.

I. Roof tape, if required over insulation joints, shall be laid evenly, smoothly and embedded in a uniform coating of hot steep asphalt with 4 inches (102 mm) end laps. Care shall be taken to assure smooth application of tape, and full embedment of the tape in the asphalt.

J. Do not install any more insulation than will be completely waterproofed each day.

3.6 INSULATION - BASE LAYER

A. The substrate shall be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

B. Install insulation layers applied with 1/4 inch (6 mm) beads of Matrix 157 spaced 6 inches (152 mm) O.C. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm) to eliminate continuous vertical gaps.

3.7 INSULATION - SUBSEQUENT LAYERS

A. The substrate shall be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

B. Install insulation layers applied with 1/4 inch beads of Matrix 157 spaced 6 inches (152 mm) O.C. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm) to eliminate continuous vertical gaps.

3.8 MEMBRANE APPLICATION

A. Fully Adhered:

1. Place membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles shall be removed from the sheet prior to permanent attachment. Roof membrane shall be fully adhered immediately after it is rolled out, followed by welding to adjacent sheets.
2. Overlap roof membrane a minimum of 3 inches (150 mm) for side laps and 3 inches (150 mm) for end laps.
3. Install membrane so that the side laps run across the roof slope lapped towards drainage points.
4. All exposed sheet corners shall be rounded a minimum of 1 inch (25 mm).
5. Use full width rolls in the field and perimeter region of roof.
6. Use appropriate bonding adhesive for substrate surface, applied with a solvent-resistant roller, brush or squeegee.
7. Fully adhere membrane sheets with bonding adhesive at a rate resulting in 60 square feet/gallon (1.4 sqm/l) of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 square feet/gallon (3 sqm/l) of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 square feet per gallon (2.8 sqm/l) (Solvent Based) and 250 square feet per gallon (6 sqm/l) (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition.
8. Prevent seam contamination by keeping the adhesive application 2 inches (51 mm) back from the seam area.
9. Adhere approximately one half of the membrane sheet at a time. One half of the sheet's length shall be folded back in turn to allow for adhesive application. Lay membrane into adhesive once the bonding adhesive is tacky to the touch.
10. Roll membrane with a weighted roller to ensure complete bonding between adhesive and membrane.
11. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.

12. Weld shall be a minimum of 1-1/2 inches (38 mm) in width for automatic machine welding and a minimum 2 inches (51 mm) in width for hand welding.
13. All cut edges of reinforced membrane shall be sealed with EverGuard TPO Cut Edge Sealant.
14. Supplemental membrane attachment is required at the base of all walls and curbs, and where the angle of the substrate changes by more than ten (5) degrees (1 inches in 12 inches) (75 mm in 1000 mm). Roofing membrane shall be secured to the structural deck with appropriate Drill-Tec screws and plates spaced every 12 inches (305 mm) o.c. The screws and plates shall be installed no less than 1/2 inch (13 mm) from the membrane edge. Alternatively, the roofing membrane may be turned up the vertical plane a minimum of 3 inches (76 mm) and secured with screws and termination bar fastener spacing is the same as is used for in-lap attachment. The termination bar shall be installed within 1-1/2 inches (38 mm) to 2 inches (51 mm) of the plane of the roof membrane, with a minimum of 1 inch (25 mm) of membrane extending above the termination bar.
15. Supplemental membrane attachment to the structural deck is required at all penetrations unless the insulation substrate is fully adhered to the deck. Roofing membrane shall be secured to the deck with appropriate Drill-Tec screws and plates.
16. Fasteners shall be installed to achieve the proper embedment depth. Install fasteners without lean or tilt.
17. Install fasteners so that the plate or termination bar is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate or termination bar to move (underdriving), but will not cause wrinkling of the membrane (overdriving).

3.9 FLASHINGS

A. General:
1. All penetrations must be at least 24 inches (610 mm) from curbs, walls, and edges to provide adequate space for proper flashing.
2. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
3. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
4. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2 inch (51 mm) wide (hand welder) weld is required.
5. All cut edges of reinforced membrane must be sealed with EverGuardSYMBOL 226 TPO Cut Edge Sealant.
6. Consult the EverGuard® Application and Specifications Manual or GAFMC Contractor Services for more information on specific construction details, or those not addressed in this section.

B. Coated Metal Flashings:
1. Coated metal flashings shall be formed in accordance with current EverGuard construction details and SMACNA guidelines.
2. Coated metal sections used for roof edging, base flashing and coping shall be butted together with a 1/4 inch (6 mm) gap to allow for expansion and contraction. Hot-air weld a 6 inch (152 mm) wide reinforced membrane flashing strip to both sides of the joint, with approximately 1 inch (25 mm) on either side of the joint left un-welded to allow for expansion and contraction. 2 inch (51 mm) wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
3. Coated metal used for sealant pans, scupper inserts, corners of roof edging, base flashing and coping shall be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. Hot-air weld a 6" wide reinforced membrane flashing strip over all seams that will not be sealed during subsequent flashing installation.

4. Provide a 1/2 inch (12 mm) hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
5. Provide a 1/2 inch (12 mm) hem for all metal flange edges whenever possible to prevent wearing of the roofing and flashing membranes at the flange edge.
6. Coated metal flashings shall be nailed to treated wood nailers or otherwise mechanically attached to the roof deck, wall or curb substrates, in accordance with construction detail requirements.

C. Un-reinforced Membrane Flashings:
1. Un-reinforced membrane is used to field-fabricate penetration or reinforcement flashings in locations where preformed corners and pipe boots cannot be properly installed.
2. Penetration flashings constructed of un-reinforced membrane are typically installed in two sections, a horizontal piece that extends onto the roofing membrane and a vertical piece that extends up the penetration. The two pieces are overlapped and hot-air welded together.
3. The un-reinforced membrane flashing shall be adhered to the penetration surface. Apply bonding adhesive at a rate resulting in 60 square feet/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 square feet/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 square feet per gallon (Solvent Based) and 250 square feet per gallon (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.

D. Reinforced Membrane Flashings:
1. The thickness of the flashing membrane shall be the same as the thickness of the roofing membrane.
2. Membrane flashing may either be installed loose or fully adhered to the substrate surface in accordance with "Construction Detail Requirements".
3. Where flashings are to be fully adhered, apply bonding adhesive at a rate resulting in 60 square feet/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 square feet/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 square feet per gallon (Solvent Based) and 250 square feet per gallon (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.
4. Apply the adhesive only when outside temperature is above 40 degrees F. Recommended minimum application temperature is 50 degrees F to allow for easier adhesive application.
5. The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.

E. Self-Adhered Membrane Flashings:
1. Install self-adhering membrane flashings according to all applicable GAFMC construction details.
2. Apply flashing membrane only when outside temperature is above 40 degrees F. Recommended minimum application temperature is 50 degrees F to allow for improved adhesive performance.
3. The membrane flashing shall be carefully positioned prior to removal of release film to avoid wrinkles and buckles.
4. Adhere flashing membrane to the walls by removing the release film. Broom or roll all walls. All seams shall be rolled-in with a silicone roller.

F. Roof Edges:
1. Roof edge flashings are applicable for gravel stop and drip edge conditions as well as for exterior edges of parapet walls.
2. Flash roof edges with metal flanges nailed 4 inches (102 mm) O.C. to pressure-treated wood nailers. Where required, hot-air weld roof membrane to coated metal flanges.
3. When the fascia width exceeds 4 inches (102 mm), coated metal roof edging must be attached with a continuous cleat to secure the lower fascia edge. The cleat must be secured to the building no less than 12 inches (305 mm) O.C.
4. Alternatively, roof edges may be flashed with a 2-piece snap on fascia system, adhering the roof membrane to a metal cant and face nailing the membrane 8" on center prior to installing a snap-on fascia.
5. Flash roof edge scuppers with a coated metal insert that is mechanically attached to the roof edge and integrated as a part of the metal edging.

G. Parapet and Building Walls:
1. Flash walls with EverGuard TPO membrane adhered to the substrate with bonding adhesive, loose applied (Less than 18 inches (457 mm) in height) or with coated metal flashing nailed 4 inches (102 mm) on center to pressure-treated wood nailers.
2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened 8 inches (203 mm) on center; termination bars that are counter flashed shall be fastened 12 inches (305 mm) on center.
3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
    a. Mechanically Attached Systems: Per in-lap on center spacing, with a 12 inch (305 mm) maximum
    b. Fully / Self Adhered Systems: 12 inches (305 mm) on center
    c. Ballast Applied Systems: 8 inches (203 mm) on center
4. All coated metal wall flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
5. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with EverGuard® caulking.
6. Flash wall scuppers with a coated metal insert that is mechanically attached to the wall and integrated as part of the wall flashing.

H. Curbs and Ducts:
1. Flash curbs and ducts with EverGuard TPO membrane adhered to the curb substrate with bonding adhesive, loose applied (Less than 18 inches (457 mm) in height) or with coated metal flashing nailed 4 inches (102 mm) on center to pressure-treated wood nailers.
2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the curb/duct surface and membrane flashing underneath all termination bars. Exposed termination bars shall be mechanically fastened every 8 inches (2.3 mm) o.c.; termination bars that are counter flashed shall be fastened 12 inches (305 mm) on center.
3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
    a. Mechanically Attached Systems: Per in-lap on center spacing, with a 12 inches (305 mm) maximum
    b. Fully / Self Adhered Systems: 12 inches (305 mm) on center

c. Ballast Applied Systems: 8 inches (203 mm) on center

4. All coated metal curb flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
5. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with EverGuard® caulking.

I. Roof Drains:

1. Roof drains shall be fitted with compression type clamping rings and strainer baskets. Original-type cast iron and aluminum drains, as well as retrofit-type cast iron, aluminum or molded plastic drains are acceptable.
2. Roof drains shall be provided with a minimum 36 inches (914 mm) by 36 inches (914 mm) sump. Slope of tapered insulation within the sump shall not exceed 4 inches (102 mm) in 12 inches (305 mm).
3. Extend the roofing membrane over the drain opening. Locate the drain and cut a hole in the roofing membrane directly over the drain opening. Provide a 1/2 inch (13 mm) of membrane flap extending past the drain flange into the drain opening. Punch holes through the roofing membrane at drain bolt locations.
4. For cast iron and aluminum drains, the roofing membrane shall be set in a full bed of water block on the drain flange prior to securement with the compression clamping ring. Typical water block application is one 10.5 ounce (315 g) cartridge per drain.
5. Lap seams shall not be located within the sump area. Where lap seams will be located within the sump area, a separate roof membrane drain flashing a minimum of 12 inches (305 mm) larger than the sump area shall be installed. The roof membrane shall be mechanically attached 12 inches (305 mm) on center around the drain with screws and plates. The separate roof drain flashing shall be heat welded to the roof membrane beyond the screws and plates, extended over the drain flange, and secured as above.
6. Tighten the drain compression ring in place.

3.10 NON-INTERLOCKING PAVERS

A. Install non-interlocking concrete pavers in accordance with requirements determined by the most current revision of ASCE 7 and the paver manufacturer's requirements.

B. Utilize perimeter securement of non-interlocking pavers in accordance with the paver manufacturer's requirements.

3.11 TRAFFIC PROTECTION

A. Install walkway pads/rolls at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.

B. Walkway pads shall be spaced 2 inches (51 mm) apart to allow for drainage between the pads.

C. Fully adhere walkway pads/rolls to the roof membrane with solvent-based bonding adhesive, applied at the rate of 1 gal per 100 sf (0.42 l/sm) to both the walkway and roof membrane surfaces. Press walkway in position once adhesive is tacky to the touch.

D. Alternatively, walkway pads/rolls may be hot-air-welded to the roof membrane surface continuously around the perimeter of the pad/roll.

3.12 ROOF PROTECTION

A. Protect all partially and fully completed roofing work from other trades until completion.

B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.

C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.

D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.13 CLEAN-UP

A. All work areas are to be kept clean, clear and free of debris at all times.

B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.

C. All tools and unused materials shall be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.

D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.

E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.

F. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions established within General and Supplementary Conditions of the Contract, Division 1 – General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES:

A. Roof eave flashings.
B. Counterflashings at edge of roofing.
C. Downspouts and gutters.
D. Roof ventilators.
E. Sheet metal roofing.
F. Wall flashings at balconies and breezeways.
G. Fireplace caps.
H. Masonry Veneer Through Wall Flashing and Step Flashing
I. Transition and Zee Flashing

1.3 SUBMITTALS

A. General: Submit following items under provisions of Section 01340.
B. Product Data: Indicating performance and physical characteristics of roof ridge ventilators, gutter, and downspouts and accessories proposed for use.
C. Color Charts: Manufacturer's standard pre-finished product charts showing actual physical coating for gutters, downspouts, and roof edge drip flashing.
D. Manufacturer's Instructions: Printed manufacturer's installation instructions.
E. Warranty: Two copies of watertightness warranty, and finish coating warranty on pre-finished products for gutters, downspouts, and roof edge drip flashing.
F. Submit samples under provisions of Section 01340.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in sheet metal flashing work with three years minimum experience in similar sized installations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and protect products under provisions of Sections 01610 and 01620.
B. Stack pre-formed material to prevent twisting, bending, and abrasions, and to provide ventilation.
C. Prevent contact with materials which may cause discoloration or staining.
D. Ship pre-coated products with strippable covering.

1.6 WARRANTY

A. Provide warranties under provisions of Section 01740.
B. Provide two-year watertightness guarantee beginning at substantial completion including repair or replacement of defective materials and workmanship.

PART 2 – PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS – SHEET MATERIALS

A. Galvanized Steel (concealed counterflashings and alternate bid for roof edge drip flashing): ASTM A 525, G90 coating, hot dipped galvanized both sides flattened sheets, chemically treated, gage as

recommended in Architectural Sheet Metal Manual for intended purposes (but no less than 26 ga.), as manufacturer by Bethlehem Steel or approved equal.

B. Galvanized Steel (through wall flashing for masonry veneer): ASTM A 525, G90 coating, hot dipped galvanized both sides flattened sheets, chemically treated, gage as recommended in Architectural Sheet Metal Manual for intended purposes (but no less than 26 ga.), as manufacturer by Bethlehem Steel or approved equal.

C. Aluminum (for gutters, downspouts, and roof edge drip flashing, vents): ASTM B209, 5005 alloy, temper as required for intended application (15 KSI minimum), thickness as recommended in Specifications for Aluminum Sheet Metal Work in Building Construction for intended purposes, manufacturer at Contractor's option, pre-finished epoxy coating one side.

D. Copper for Sheet Metal Roofing: ASTM B 370, Cold rolled, weight as recommended in Architectural Sheet Metal Manual for intended purposes as manufactured by Revere Copper and Brass, Inc., Rome, NY, or approved equal.

E. Continuous Soffit Vents:
   1. Vinyl – Provided by vinyl siding supplier.

F. Off Ridge Roof Vent:
   1. Slant back, low profile style, heavy-duty 26 Ga Metal Contstruction, with aluminum screen,.
   2. Net Free Area: 26 square inches per foot, minimum.
   3. SEMCO WeatherVent or TAMCO Off Ridge Vent.

G. Ridge Vent:
   1. Low profile, 1 inch high, polypropylene construction, internal and external baffles, flexible 3-point living hinge conforming to any roof pitch; closed cell foam end plugs; designed for installation of asphalt shingles over vent.
   2. Net Free Area: 17 square inches per linear foot.
   3. Vent opening designed to keep out insects and weather infiltration.
   4. Supportive nail holes and alignment tabs.
   5. Color: Black.
   6. Accepted Products:
      a. Roof-Over-Vent-A-Ridge (ROVAR) as manufactured by Alcoa Building Products, Peoria, IL.
      b. Shingle-Over Ridge Vent Model PVR-4 with PEP-5 end plugs, as manufactured by The Solar Group, Taylorsville, MS.
      c. ShingleVent II as manufactured by Air Vent, Inc. Peoria Heights, IL

H. Sealant: One part, non-sag polyurethane.

I. Substitutions: Submit under provisions of Section 01630.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, free from distortion and defects, to profiles indicated in accordance with SMACNA Architectural Sheet Metal Manual.

B. Form pieces in longest practical lengths.

C. Hem exposed flashings on underside ½ inch; miter and seam corners.

D. Form materials which are typically concealed from view by the public with lap seams.

E. Solder and seal metal joints at balconies and door openings of upper floors, except those indicated or required to be expansive type joints. After soldering, remove flux. Wipe and wash solder joints clean.

F. Fabricate corners from one place with minimum 18 inch long legs; solder for rigidity or seal with sealant if approved by Owner.

G. Fabricate vertical faces with bottom edge formed outward 1/8 inch and hemmed to form drip.

H. Fabricate flashings to allow toe to extend minimum 2 inches over wall surfaces.

I. Fabricate as much as possible in shop with machinery to eliminate as much hand tooling on the job as possible. Shop fabricate to allow for adjustments in the field for proper anchoring and joining.

J. Trim and Bend Edges to provide positive "drip" for all through wall flashing terminations at door, window, and arched openings and other areas as indicated on the drawings.

K. Roofing:
   1. Form roofing to provide 1 inch high double locked standing seams spaced nominally 12 inches on center.

2. Turn up sides of pans and extend 1 inch above finished seam height.
3. Form cross seams with ¾ inch fold under on lower end and 2 inch fold on upper end.
4. Form pans in longest practical length.

2.3 ACCESSORIES

A. Fasteners
   1. Nails: AISI Series 300 for stainless and galvanized steel; aluminum for aluminum sheets. Use annular ring shank type, No. 12 gage or larger to suit application, or sufficient length to penetrate backing material at least 7/8 inch.
   2. Screws and Bolts: AISI Series 300 for stainless and galvanized steel; and aluminum for aluminum sheets; of sufficient size and length to sustain imposed stresses.
B. Solder Materials
   1. Flux: Type as recommended by sheet material manufacturer; not detrimental to base material. Use resin type flux for terne metal.
   2. Solder: ASTM B32 type, 50% tin/50% lead for plain copper, galvanized steel and terne metal.
C. Protected Back Paint: Zinc chromate alkyd
D. Sealants: One component polyurethane, non-sagging, sealant as specified in Section 07900.
E. Plastic Cement: FS SS-C-153, Bituminous plastic cement.

2.4 FINISHES

A. Aluminum: Pre-finished, color to be selected by Owner, for roof eave, rake edge, gutters, and downspouts.
B. Galvanized Steel (Alternate Bid): Natural finish. Refer to Section 09900 for field finishing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this section. Notify General Contractor of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.
B. Verify roof openings, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
C. Verify membrane termination and base flashings are in place, sealed and secure.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating work.

3.3 INSTALLATION

A. Install using skilled workmen in accordance with manufacturer's printed instruction and recommendations.
B. Conform to drawing details included in manuals published by AA and NRCA.
C. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Architect and Owner.
D. Lap roof eave flashings 4" and seal all joints.
E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
F. Seal metal joints watertight at gutters and downspouts.
G. Provide electrolytic separation between dissimilar metals with protective back paint.
H. On soldered metal joints, make watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.
I. Install expansion joints at frequency as recommended in SMACNA Architectural Sheet Metal Manual. Do not fasten seams such that movement is restricted. Coordinate E.J. locations with joints in adjacent materials.

J. If approved by Owner, as an alternate to soldered joints, sheet metal joints may be lapped 6" and a double bead of sealant used to seal joint watertight. Soldered joints must be maintained; however, at all formed corners, column wraps, and sill pockets for wall openings.
K. Overlap all through wall flashing at horizontal joints a minimum of 4" and seal/solder all joints.
L. Provide positive slope to promote drainage in wall cavity.
M. Seal through wall metal flashing to wall substrate with self adhering flexible membrane flashing material. Fabricate flashing such that vertical leg is not less than 8".
N. Provide "step flashing" at all areas where roof slopes intersect masonry walls and/or chimneys. Seal all steps working upwards and overlapping each subsequent level.
O. Provide Transition or Zee Flashing at Horizontal Joints between materials not specified elsewhere in the documents. Overlap all flashing a minimum of 4" and seal/solder all joints, provide posititive slope to promote drainage, proviede minimum 3" vertical leg in all locations and seal to substrate.

3.4 ROOFING INSTALLATION

A. Starting at low point, apply 1 layer slip sheet over sheathing. Weather lap sheet 4 inches minimum. Lap ends 6 inches minimum. Do not adhere or attach to substrate.
B. Apply roofing plans beginning at low edge of roof.
C. Extend edge strip under pans 4 inches minimum and secure with nails spaced 4 inches on center maximum, located 1 inch down from upper edge of strips. Hook lower end of first pans over edge strip.
D. At end joints between pans, hook fold on lower end of upper pan into fold on upper end of underlying pan.
E. Stagger end joints of adjacent pans.
F. From standing seams to 1 inch height; fold pan edges down to form double hem.
G. At intersection of roof slope with hip and ridge battens, turn up edges of roof plans against battens and terminate in ½ inch flange at top of battens. Install cover strips.
H. Form valleys of sheets not over 10 feet in length. Lap joints 6 inches minimum in direction of drainage. Extend minimum 6 inches under roofing pans on each side. Double fold valley and roofing sheets and cleat at 18 inches on center maximum or 90# rolled roofing.
I. Fit flashings with square corners and surfaces true, aligned and accurate to required profiles.

3.5 QUALITY CONTROL

A. Install surfaces flat such that from normal viewing distances, no waviness or oil canning is visible.

3.6 CLEANING

A. Perform final cleaning under provisions of Section 01710.

3.7 PROTECTION

A. Protect finished installation under provisions of Section 01500.

END OF SECTION

SECTION 076500

FLEXIBLE FLASHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Provisions established in General and Supplementary Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Wall flashing around windows, doors, and other exterior wall elements.

B. Through wall flashings at shelf angles, brick ledges, and lintels in masonry veneer walls.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installation of thru-wall flashings with 3 years minimum experience.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle, and protect products under provisions of Section 01600.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not allow plastic flashing to remain exposed to the elements for longer than 30 days.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate installation in accordance with Section 01320. Do not begin work until substrate preparation is complete.

PART 2 PRODUCTS

2.1 MODIFIED BITUMEN

A. Acceptable Products:

1. Through Wall Flashing: WR Grace Perm-A-Barrier.
2. Periemter of windows, doors, and at inside and outside corners in sheathing: WR Grace Vycor Plus Self Adhering Flashing.
3. Comparable products by Tyvek, Typar, Polyguard and Protectorwrap are also acceptable.

B. Substitutions: Submit in accordance with Section 01600.

C. Material:

1. Sheet Membrane: Rubberized asphaltic sheet laminated to a polypropylene film, 32 mil minimum total thickness, width as required for joints and flashing conditions.
2. Primer: Rubber based solvent type recommended by membrane manufacturer.
3. Mastic: Rubberized asphaltic type recommended by membrane manufacturer.
4. Liquid Membrane: Two component elastomeric, mastic grade.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

3.2 INSTALLATION

A. Install using skilled workmen in accordance with manufacturer's printed instructions and recommendations.

Prime all surfaces to receive flexible flashing material to assure complete adhesion. Use manufacturer's recommended primer.

B. Adhere flashing to sheathing backup on stud wall systems as work progresses in the following locations:
1. Around 3 sides of doors and 4 sides of windows.
2. At all inside and outside vertical corners.
3. Continuously above masonry shelf angles, lintels, and brick ledges.

C. Install for moisture flow down and away from building. Seal flashing tightly to gypsum sheathing and other substrates.

D. Seal joints in flashing and joint treatment watertight with lap distance and method as recommended by manufacturer. Create end dams to channel water back to nearest weep hole at lintels.

3.3 PROTECTION
A. Protect finished installation under provisions of Section 01500.
B. Protect flashing until placement within wall is complete. Do not allow wind to displace or damage flashing.

3.4 CLEANING
A. Perform final cleaning under provisions of Section 01780.

END OF SECTION

SECTION 077113

SHEET METAL COPING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY:

A. Work included: Furnishing and installing factory fabricated and finished coping systems.

1.02 REFERENCES:

A. Factory Mutual Research Corporation (FMRC), P.O. Box 9102, Norwood, MA 02082, 617-762-4300.
B. SPRI Sheet Membrane and Component Suppliers to the Commercial Roofing Industry, 175 Highland Ave., Needham, MA 02194, 617-444-0242, fax: 617-444-6111.

1.03 SUBMITTALS:

A. Product Data: Provide manufacturer's product and complete installation data for all materials in this specification.
B. Shop drawings: Show profiles, joining method, accessories location, anchorage and flashing details, adjacent construction interface, and dimensions.
C. Samples: Available on request; sized to represent material adequately.
D. Contract Closeout: Submit Special Warranty and Manufacturer's performance certifications [if applicable].
E. Installation Guide: The product manufacturer shall provide a written installation guide.

1.04 QUALITY ASSURANCE:

A. High performance coping shall be CERTIFIED by the coping manufacturer to meet performance design criteria according to the following test standards::
   1. ANSI/SPRI ES-1-98 Test RE-3 for Coping: Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems (current edition). The coping system shall be tested simultaneously on horizontal and vertical surfaces and shall exceed horizontal and vertical design wind pressure as calculated in accord with the ANSI/SPRI ES-1 Test RE-3. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
   2. The coping product shall be listed in current Factory Mutual Research Corporation Approval Guide approved for [select : Class FM 1-60 through FM 1-180. [Consult current FM Approval Guide or contact the factory for wall size, cleat spacing and gauge requirements.]

1.05 PRODUCT HANDLING:

A. All materials shall be delivered in the manufacturer's original sealed, labeled containers.
B. Store materials in a dry, protected, well-vented area. The contractor shall report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.
C. Remove protective plastic surface film immediately after installation [if applicable].

1.06 SUBSTITUTIONS

A. Proposals for substitution products shall be accepted only from bidding contractors a minimum of 10 working days before bid due date. The proposed substitution shall meet the performance and quality standards of this specification (see section 1.04).

1.07 JOB CONDITIONS:

A. Verify that other trades with related work are complete before mounting coping covers.
B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
C. Refer to the construction documents, shop drawings and manufacturer's installation instructions.
D. Coordinate installation with roof membrane manufacturer's instructions before starting.
E. Observe all appropriate OSHA safety guidelines for this work.

1.08 WARRANTY/GUARANTEE:

A. Special Performance/20-Year Excel Warranty: Manufacturer shall guarantee that a standard size roof edge system, when installed per manufacturer's instructions, will not blow off, leak, or cause membrane failure, even in wind conditions up to 110 mph, or the manufacturer shall replace or repair their materials.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. W. P. Hickman Company
P.O. Box 15005
Asheville, NC 28813-0005
1-828-274-4000
Fax: 1-828-274-4031
Internet address - http://www.wph.com
For local rep, contact: Sweet's Buyline 1-800-892-1165 (#0487)

B. Derbigum Americas, Inc.
4800 Blue Parkway
Kansas City, MO
800-727-9872

2.02 PARAPET COPING SYSTEM:

A. Permasnap Coping: Metal coping cap with galvanized steel anchor cleats and gutter splice plate for capping any parapet wall. The system shall be watertight, maintenance free, and not require exposed fasteners or sealant. Joints shall be butt type with concealed splice plates.

B. Performance characteristics:
1. Coping sections shall expand and contract freely while mechanically locked in place on anchor cleats.
2. Coping sections shall lock to anchor cleats by mechanical pressure.
3. All coping cover joints shall be underlayed with raised rib channels capable of draining water.

C. Metal: (.063" aluminum with Kynar coating).

D. Coping cap: Length of 10'-0" (3048 mm); width of approx 12" verify / coordinate with High Density Elevations.

E. Coping vertical face and back leg: standard 4" (100 mm) nominal; custom size by request.

F. Internal splice plates: Shall be concealed with matching finish to maintain outside face continuity.

G. Coping Cleat: 16 gauge galvanized steel anchor cleat; normally 12" (305 mm) wide @ 5'-0" (1524 mm) on center to be mechanically fastened as indicated and detailed with supplied fasteners.

H. Splice/Gutter: 6" wide full splice plate with raised ribs to channel water.

I. Fasteners:Shall be screw type with a minimum pull-out resistance of 240 # (109 kg) as supplied by the manufacturer per substrate application. No exposed fasteners shall be permitted. Fasteners shall be electrolytically compatible.

J. Finishes: Shall be **standard precoated Kynar-500 from manufacturer's color list. . Color shall be as selected by Owner/Architect.**

2.03 ACCESSORIES:

A. Corners, end caps, pier caps, etc. shall be fabricated by the coping manufacturer. Factory fabricated, mitered corners shall have nominal 24" (610 mm) leg lengths.

B. Welded or METAL-LOCK® assembly shall be used to maintain watertight integrity.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Verify that coping installation will not disrupt other trades. Verify that substrate is dry, clean and free of foreign matter. Report and correct defects prior to any installation.

3.02 INSTALLATION:

A. Submit product design drawings for review and approval to Architect or Specifier before fabrication.

B. Installing contractor shall check as-built conditions and verify the manufacturer's coping details for accuracy to fit the wall assembly prior to fabrication. The installer shall comply with the coping manufacturer's installation guide when setting copings.

C. Installer shall use mechanical fasteners with minimum 240 # (109 kg) pull-out resistance as supplied manufacturer; threaded and suitable for parapet substrates.

END OF SECTION

SECTION 077123

GUTTERS, LEADERS, AND DOWNSPOUTS

1.00 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including general and supplementary conditions and Division 1 – General requirements, apply to work specified in this section.

1.2 DESCRIPTION OF WORK

A. Extent of this work shall be as indicated on drawings and/or specified herein.

2.00 PRODUCTS

2.01 MATERIALS

A. Type: Six (6) inch continuous, seamless, aluminum gutters.
   1. Material: **Primed aluminum (Finish Paint to match adjacent wall/trim finish)** Minimum Gutter Thickness .032 Aluminum.
   2. Depth: Six (6) inches Width Six (6)inches
   3. Fasteners: Stainless steel or aluminum per manufacturer's recommendations.

B. Type: 3" X 4" oversize aluminum downspouts. Min Thickness .032 Aluminum

C. Finish: **Primed aluminum (Finish Paint in colors (Multiple) to match adjacent wall/trim finish) final color approved by Architect/Owner.**

D. Install and seal end caps.

E. Provide downspout "boots" at connection into underground perimeter drainage system. (J.R. Hoe O Series Offset Downspout Boot or equal)

3.00 EXECUTION

3.01 FABRICATION

A. Fabricate components in accordance with SMACNA Manual.
B. Fabricate vertical faces with bottom edge formed outward ¼ inch and hemmed to form drip.
C. Form sections accurate to size and shape, square and free from distortion and defects.
D. Provide for thermal expansion and contraction in sheet metal exceeding 15 feet in running length.
E. Fabricate cleats and starter strips of same material as sheet metal.
F. Gutters and Downspouts:
   1. Fabricate in continuous lengths from precoated aluminum sheet.
   2. Profiles: As indicated.
   3. End caps, downspout outlets and headers, straps, brackets, and downspout strainers: Profile to suit gutters and downspouts.

3.02 INSTALLATION

A. Install flashing and sheet metal as indicated and in accordance with SMACNA Manual.
B. Install cleats and starter strips before starting installation of sheet metal.
C. Secure flashings with concealed fasteners where possible.
D. Seal all Concealed Fasteners
E. Apply plastic cement between metal and felt flashings.
F. Fit flashings tight, with square corners and surfaces true and straight.
G Seam and seal joints watertight.
H. Separate dissimilar metals with bituminous coating or non-absorptive gaskets.
I. Provide weeps at balcony edges at maximum spacing of 32 inches on center.

J. Gutters and Downspouts:
   1. Flash and seal gutters to downspouts.
   2. Slope gutters 1/8 inch in 10 feet minimum.
K. Apply sealants as specified in Section 07900.

END OF SECTION

SECTION 078400

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Firestopping perimeter and penetrations of fire rated assemblies.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. E 119 - Method for Fire Tests of Building Construction and Materials.
   2. E 814 - Test Method of Fire Tests of Through-Penetration Firestops.

1.3 SYSTEM DESCRIPTION

A. Provide continuous protection against passage of heat, fire, smoke, and gases at perimeter of and penetrations through fire rated assemblies.

1.4 QUALITY ASSURANCE

A. Firestopping: Tested and approved by recognized independent testing laboratory in accordance with ASTM E 119 or E 814 with fire resistance rating equivalent to adjacent construction.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300:
   1. Product Data: Include product description, limitations in use, and fire hazard classifications and ratings.
   2. Test Reports: Indicate conformance with ASTM E 814.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not apply sealants, mortars, or foams when temperature of substrate material and surrounding air is below 40 degrees F or is anticipated to drop below that temperature within 24 hours after installation.
B. Maintain sealant at a minimum 70 degrees F.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Silicone Elastomer Compound: Single or multiple component silicone penetration sealant or intumescent elastomeric sealant.
B. Putty: Single component ceramic fiber base putty or intumescent elastomer putty that expands on exposure to surface heat gain.
C. Foam Compound: Two component foamed silicone elastomer.
D. Formulated Compound: Formulated compound r-nixed with incombustible non-asbestos fibers.
E. Pillows: Formed mineral fiber pillows.
F. Mechanical Devices: Incombustible fillers or silicone elastomer covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.

2.2 ACCESSORIES

A. Forming and Damming Materials: As recommended by firestopping manufacturer for intended use.
   1. Permanent: Mineral fiberboard, mineral fiber matting, or mineral fiber putty.
   2. Temporary: Plywood, particleboard, or other.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare openings to receive firestopping as directed by manufacturer:
   1. Remove incidental and loose materials from penetration opening.
   2. Remove free liquids and oil from involved surfaces and penetration components.
   3. Install damming materials to accommodate and ensure proper thickness and fire rating requirements and provide containment during installation.
   4. Remove combustible materials and materials not intended for final penetration seal system.

3.2 INSTALLATION

A. Apply materials in accordance with manufacturer's instructions.
B. Apply firestopping material in sufficient thickness to achieve required ratings.
C. Compress fibered material to achieve a density of 40 percent of its uncompressed density.
D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
E. Place intumescent coating in sufficient coats to achieve rating required.
F. Remove dam material after firestopping material has cured.
G. Finish exposed surfaces to smooth, flush appearance.

END OF SECTION

SECTION 079200

JOINT SEALANTS AND CAULKING

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Joint backup materials.
   2. Sealants.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C 834: Latex Sealing Compounds.
   2. C 920: Elastomeric Joint Sealants.
   3. D 1565: Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

1.3 SUBMITTALS

A. Submit under provisions of Section 01300:
   1. Product Data: Sealants, primers, backup, bond breakers, and accessories proposed for use.
   2. Samples:
      a. Sealant samples showing available colors.
      b. Joint fillers and bond breaker tape, submit samples of leak type.

B. Provide guarantee covering sealant materials **and caulking** for a five (5) year period covering joint failure. Joint failure is defined as: Leaks of air or water; evidence of loss of cohesion; fading of sealant material; migration of sealant; evidence of loss of adhesion between sealant and joint edge.

1.4 PROJECT CONDITIONS

A. Do not apply sealants at temperatures below 40 degrees F unless approved by sealant manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Joint Sealants: 1. Top Industrial, Inc., Sonneborn, Tremco, Vulkem

B. Substitutions: Under provisions of Section 01600.

2.2 MATERIALS

A. Joint Sealants:
   1. Type 1:
      a. ASTM C 920, Type M, Grade P, Class 25; multi component polyurethane, self-leveling.
      b. Movement capability-. Plus or minus 25 percent.
      c. Color: To be selected.
   2. Type 2:
      a. ASTM C 920, Type S, Grade NS, Class 25; single component polyurethane or silicone, non-sag.
      b. Movement capability: Plus or minus 25 percent. Color: To be selected.
   3. Type 3:
      a. ASTM C 834, single component acrylic latex, non-sag.
      b. Movement capability: Plus or minus 7-1/2 percent.
      c. Color: To be selected.
   4. Type 4:
      a. ASTM C 920, Type S, Grade NS, Class 25; single component silicone, non sag, mildew resistant.
      b. Movement capability: Plus or minus 25 percent.
      c. Color: To be selected.

2.3 ACCESSORIES

A. Primers, Bondbreakers, and Solvents: As recommended by sealant manufacturer.

B. Joint Backing:

1. ASTM D 1565, closed cell polyurethane foam, preformed round joint filler, non absorbing, non staining, resilient, compatible with sealant and primer, recommended by sealant manufacturer for each sealant type.
2. Size: Minimum 1.25 times joint width.

2.4 MIXES

A. Follow manufacturer's instructions.

B. Mix multiple component sealants by mechanical mixer; avoid air entrainment and overheating occurring during mixing.

C. Continue mixing until color is completely uniform, without streaks.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose and foreign matter that could impair adhesion. If surface has been subject to chemical contamination, contact sealant manufacturer for recommendation.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Protect adjacent surfaces from damage.

D. Sealant Dimensions:

1. Minimum joint size: ¼ inch by ¼ inch.
2. Joints ¼ inch to 1-1/2 inch wide-. Depth equal to width.
3. Joints over 112 inch wide: Depth equal to 1-1/2 width.

3.2 APPLICATION

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

B. Install joint backing to maintain required sealant dimensions. Compress backing approximately 25 percent without puncturing skin. Do not twist or stretch.

C. Use bondbreaker tape where joint backing is not installed.

D. Fill joints full without out air pockets, embedded materials, ridges, and sags.

E. Tool sealant to smooth profile.

F. Apply sealant within recommended temperature range. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.3 CLEANING

A. Remove masking tape and protective coatings after sealant has cured.

B. Clean adjacent soiled surfaces.

3.4 SEALANT SCHEDULE

A. **JOINT LOCATION OR TYPE** **SEALANT TYPE**

Exterior Joints:
Horizontal joints subject to
pedestrian or vehicular traffic 1

Other joints 2

Interior Joints:
Joints in bathrooms and showers 4

Other joints 3

END OF SECTION

SECTION 081110

HOLLOW METAL WORK

PART 1 GENERAL

1.01 WORK under this section comprises of furnishing and installing hollow metal frames for doors, windows and hollow metal doors and panels.

1.02 RELATED DOCUMENTS, drawings and general provisions of contract, general and Supplementary conditions and Division 1 specifications sections apply to this section.

1.03 RELATED WORK, specified elsewhere that should be examined for its effect upon this section.

A. Section 08400 Entrances and Storefronts

B. Section 08710 Finish Hardware

C. Section 08800 Glass and Glazing

D. Section 09900 Painting

1.04 REFERENCES SPECIFIED in this section subject to compliance as directed:

A. UL 10B -93, Fire Tests of Door Assemblies.

B. ASTM-A366-95A - Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

C. ASTM-A568-95 -Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

D. ASTM-A 569-91A - Specification for Steel, Carbon, (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.

E. ASTM-A924-95 - General Requirements for Steel Sheet, Metallic coated by the Hot-Dip Process.

F. ASTM-A620- Specifications for Steel, Sheet, Carbon, Drawing Quality, Special Killed, Cold Rolled (for embossed panels).

G. ANSI A250.8-1998/SDI100 - Recommended specifications for standard steel doors and frames.

H. SDI-105-92 - Recommended Erection Instructions for Steel Frames.

I. ANSI/SDI A250.6 - 1997 - Hardware on Steel Doors (reinforcement-application).

J. NFPA-80-1995 - Standard for Fire Doors and Windows.

K. NFPA-101-1994 - Life Safety Code.

L. ANSI-A250.4-1994 Test Procedure and acceptance criteria for physical endurance, steel doors and frames.

M. ANSI-A224.1-1990 Test Procedure and acceptance criteria for prime painted steel surfaces for steel doors and frames.

N. ADA, The Americans with Disabilities Act - Title III - Public Accommodations

O. ANSI-A117.1-1992 American National Standards Institute - Accessible and Usable Buildings and Facilities

P. U. L. - Underwriter's Laboratories

Q. WHI - Warnock Hersey International, Division of Inchcape Testing Services

R. State and Local codes including Authority Having Jurisdiction

1.05 SUBMITTALS

A. Shop Drawings: Indicate door and frame elevations and sections, materials, gages and finishes,fabrication and erection details, locations of finish hardware by dimension and locations/details of all openings and louvers. Do not proceed with any fabrication until all details are approved.

B. Certification of Compliance: Submit any information necessary to indicate compliance to these specifications.

C. Submit full size door and frame sample to the site for Owner approval.

1.06 QUALITY ASSURANCE

A. Certification of label construction: For components exceeding Underwriters Laboratories, Inc. (UL)- furnish inspection certificate stating that component construction conforms to UL rating requirements only if Architect is aware of such a limitation and has allowed the non-labeled unit.

B. Hollow metal supplier shall be a qualified direct distributor of products to be furnished. In addition the distributor shall have in their regular employment an A.H.C./C.D.C. or person of equivalent experience who will be available at reasonable times to consult with the Architect/Contractor and/or Owner regarding any matters affecting the total door and frame openings.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver doors and frames cardboard wrapped, crated, palletized or otherwise protected during transit and site storage.

B. Inspect doors and frames upon delivery for damage.Minor damages may be repaired provided refinished items are equal in all respects to new work and accepted by the Architect. Otherwise remove and replace damaged items.

C. Store doors and frames at the building site in a dry, secure place.
1. Place units on minimum 4 inches (101.6) high wood blocking.
2. Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber.
3. If cardboard wrapper/packaging on door becomes wet, remove packaging materials immediately.
4. Provide 1/4 inch (6.3) spaces between stacked doors to promote air circulation.

1.08 SEQUENCING AND SCHEDULING

A. Deliver all doors and frames to the jobsite in a timely manner so not to delay progress of other trades.

B. Issue purchase orders to frame, door and other hardware suppliers early so not to interfere with normal quoted delivery of materials.

1.09 WARRANTY

A. Hollow metal doors and frames shall be supplied with a one (1) year warranty against defects in materials and workmanship.

B. Warranty to commence with substantial completion of the job.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS (providing the products supplied comply with this specification)

A. Republic Builders Products Corp., McKenzie, Tn.

B. CURRIES Co., Mason City, Iowa

C. COPCO Door Co., Warren, Michigan

D. Mesker Door, Inc. Huntsville, AL

2.02 MATERIALS

A. Steel requirements, all doors and frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM-A-366 and A-568 general requirements or galvanealed to 'A-60' minimum coating weight standard per ASTM-A924. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.

B. Coating Materials, primer, Use manufacturer's standard rust inhibiting primer conforming to ANSI-A-224.1-1990.

C Core Materials

1. Nonlabeled doors or labeled doors, polystyrene foam core, self-extinguishing, non-toxic in case of fire.
2. Fire labeled doors with temperature rise rating to have a mineral fiber core sufficient to obtain a 250 degree F (121 C) temperature rating.

D. Glass lite frames in doors fabricated of not less than 18 ga.(1.2) galvanized steel with attachment screws allowed only on the non-secure side, not visible when viewing door lite frame face.

2.03 FABRICATION

A. General

1. Fabricate all doors and frames in accordance with ANSI A250.8-1998/SDI-100 except where more stringent requirements are specified.
2. Prepare doors to receive finish hardware per approved schedule. Include all thru-bolting holes as required per hardware template. not include unnecessary cutouts in door faces not required hardware template.
3. Supply only doors and frames manufactured by one (1) of the acceptable manufacturers listed in this specification.

B. Doors

1. Classification: SDI Level 2 - Model 2 - seamless design.
2. Face sheets: Minimum of 18 ga.(1.2) cold rolled steel for interior and exterior.
3. Seamless construction by welding and filling at factory only
4. Vertical lock edges beveled 1/8 inch (3.2) in 2 inches (50.8).
5. Top and bottom channels

a. Not less than 16 ga.(1.4) - flush or inverted
b. Welded to the face sheets.
c. Close tops of outswinging exterior doors flush by the addition of steel top channel fillers necessary.

6. Astragals: Where called for to be flat security type or 'Z' as called for in drawings or specifications..
7. All doors conform to ANSI-A250.4-1994 Level 'A' criteria and be tested to 1,000,000 operating cycles and 23 twist tests. Certification of Level 'A' doors is to be submitted with approval drawings by the distributor. Do not bid or supply any type or gage of door not having been tested and passed this criteria.
8. All Vision Lites installed in Doors to be Located 42" MAX AFF to bottom of visible portion of glazing.

C. Frames
1. Construction: 16 ga.(1.4) cold rolled steel at interior locations, 14 gage (1.9) galvanized at exterior locations.
2. All frames set in masonry walls are to be face welded and ground smooth, and re-primed at the welded area.
3. Provide temporary shipping bars to help protect from damage during transit and handling.
4. Temporary shipping bars to be removed before setting frames.
5. All welds on frames, transoms and sidelites to be flush with neatly mitred or butted material cuts.

D. Frame Anchors
1. Wall anchors for frame attachment to masonry construction:
Masonry anchors, adjustable, flat, corrugated or perforated 'T' shaped anchors with leg not less than 2 inches(50) wide by 10 inches (254)long or masonry "wire" type not less than 3/16 inch (5) diameter.
2. Wall anchors for attachment to drywall partitions
a. Use manufacturer's adjustable type compression anchors with knocked down die mitred frames at drywall locations.
b. Use steel or wood stud anchors sized to accomodate frame jamb depth and face dimension on all welded frames.
3. All frame jamb anchors to be provided; one each jamb per 30 inches (762)of frame height or fraction thereof.
4. Floor anchors: Angle clip type
a. 16 ga.(1.4) minimum.
b. To receive 2 fasteners per jamb.
c. Welded to the bottom of each jamb.
5. In place masonry or concrete:
a. 3/8 inch(9.5) countersunk flat head stove bolt and expansion shields.
b. Weld pipe spacers or other type of spacers per manufacturer's standard design in back of frame soffit to protect frame profile during tightening of bolts and anchors.

6. Head struts: For frames not anchored to masonry or concrete construction provide ceiling struts spot welded to jambs each side extending to building structure where called for on schedule.

E. Preparation For Hardware
1. Reinforcement: Reinforce components for hardware installation in accordance with ANSI A250.6-1997.
a. All lock and closer reinforcements to be "box" or "channel" type.
b. All hinge and lock reinforcing on doors is to be channel type, continuous from top to bottom of door, welded to face sheets.

2.Punch single leaf frames to receive three (3) silencers. Double leaf frames to receive one silencer per leaf at head.

3. Factory prepared hardware locations to be in accordance with "Recommended locations for Builders' Hardware for Standard Steel Doors and Frames", as adopted by The Steel Door Institute.

4.Supply welded in mortar guards at all hardware cutouts in frames built into masonry or grouted in full.

PART 3 - EXECUTION

3.01 SETTING FRAMES

A Set all frames in accordance with SDI 105-92.

B. Set welded frames in position prior to beginning partition work. Brace frames until permanent anchors are set.

C. Set anchors for frames as work progresses. Install anchors at hinge and strike levels.

D. Use temporary setting spreaders at all locations. Use intermediate spreaders to assure proper door clearances and header braces for grouted frames.

E. Install frames in prepared openings in concrete and masonry walls using countersunk bolts and expansion sheilds.

F. Install all K.D. drywall frames plumb and true with only hairline seams allowed at all head and jamb joints connections.

G. Install all fire rated frames in accordance with requirements of NFPA-80-1995

3.02 DOOR INSTALLATION

A. Install hollow metal doors in frames using hardware specified in Section 08710 Finish Hardware.

B. Clearances at edge of doors

1. Between door and frame at head and jambs: 1/8 inch (3.2).
2. At meeting edges pairs of doors and at mullions: 1/8 inch (3.2).
3. At transom panels, without transom bars: 1/8 inch (3.2).
4. At sills without thresholds: 5/8 inch (15.9) maximum above finish floor.
5. At sills with thresholds: 1/8 inch (3.2) above threshold.
6. All Vision Lites installed in Doors to be Located 42” MAX AFF to bottom of visible portion of glazing

3.03 ADJUSTMENT AND CLEANING

A. Remove dirt and excess sealants, mortar or glazing compounds from exposed surfaces.

B. Adjust moving parts for smooth operation. Use shims if necessary to allow for proper closing.

C. Fill all dents, holes, etc. with metal filler and sand smooth and flush with adjacent surfaces - Reprime/paint to match finish.

END OF SECTION

SECTION 081118

PRE-ASSEMBLED METAL DOOR AND FRAME UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulated Metal Unit Entry doors and Insulated Metal French Patio Doors
B. Wood door frames.

1.2 RELATED SECTIONS

A. Section 06200 - Finish Carpentry: Wood trim.
B. Section 08210 - Wood Doors.
C. Section 08710 - Door Hardware: Surface-mounted hardware.
D. Section 09900 - Paints and Coatings: Field-finishing of doors and frames.

1.3 REFERENCES

A. ANSI A224.1 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames. (Same as ISDI-106)
B. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.
C. ANSI/DHI A115 - American National Specifications for Steel Doors and Frames Preparation for Hardware; Door and Hardware Institute.
D. ASTM A 591/A 591M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
E. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
F ISDI 102 - Installation Standard for Insulated Steel Door Systems; Insulated Steel Door Institute. (ANSI/ISDI 102).
G. NFPA 80 - Standard for Fire Doors and Windows.
H. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
I. SDI 100 - Recommended Specifications for Standard Steel Doors & Frames; Steel Door Institute.
J. SDI 105 - Recommended Erection Instructions for Steel Frames; Steel Door Institute.
K. WHI - Certification Listings; Warnock Hersey International Inc.
L. UL 10B - Standard for Fire Tests of Door Assemblies; Underwriters Laboratories Inc.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.
B. Product Data: Manufacturer's descriptive literature demonstrating compliance with referenced standards.
C. Shop Drawings: Indicate the following:
    1. Door and frame schedule; include elevations, sizes, handing.
    2. Locations and sizes of lites and louvers, if indicated.
    3. Frame sizes, profiles, and throat depths.
    4. Hardware preparation.
D. Manufacturer's printed installation instructions for each specified product.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member of Insulated Steel Door Institute (ISDI).
B. Installer Qualifications: Minimum three (3) years documented experience installing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect products from moisture, construction traffic, and damage; store under cover.
   1. Place units on 4 inch (100 mm) high wood sills to prevent rust or damage.
   2. Provide 1/4 inch (6 mm) space between doors to promote air circulation.

B. Do not use non-vented plastic or canvas shelters; should wrappers become wet, remove immediately.

1.7 WARRANTY

A. Provide manufacturer's warranty of its products, commencing at date of purchase, against the following:
   1. Defects in product workmanship and materials, excluding wood components, for two (2) years.
   2. Defects in glass, for ten (10) years..
   3. Rust, for ten (10) years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:
   - Masonite Entry Systems
   - Therma Tru Entry Systems

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

C. Unless otherwise specified for an individual product or material, supply all products specified in this section from the same manufacturer.

2.2 DOORS AND FRAMES

A. All Doors and Frames: Pre-assembled door and frame units, complying with the following:
   1. Physical Endurance: Standard 3 feet by 8'–0 **"** door to meet requirements of ANSI A250.4 procedure for level C doors for 250,000 cycles.
   2. Hardware preparation in accordance with ANSI/DHI 115.

B. Fire-Rated Doors and Frames: Comply with NFPA 252, ASTM E 152, UBC Std 7-2 (UBC 43-2), UL 10B, or CAN4-S104, as required by authority having jurisdiction.
   1. Tested by Warnock-Hersey.
   2. Attach fire rating label of certifying agency to fire-rated doors and frames; use mylar or metal labels.

C. Main Entrance Doors:
   1. 20 minute rated Pre-assembled and pre-hung with steel frames and hinges.
   3. **Two**-panel, embossed.

D. Patio Balcony Doors: 8'-0" Tall Pre-assembled, pre-hung door and frame units.
   1. Outswinging single door.
   2. Flush, full tempered, insulated glass lite, no muntins.

2.3 DOOR, SIDELIGHT, AND TRANSOM COMPONENTS

A. Doors - General Requirements:
   1. Thickness: 1-3/4 inches (44 mm) nominal.
   2. Face sheets: Electro-galvanized steel conforming to ASTM A 591/A 591M, commercial quality; visible seams on face sheets not permitted.
   3. Vertical edges: Integrally formed in face sheet and continuous flush interlocking seams joining face sheets, unless otherwise indicated.
   4. Light openings: Formed steel edges made by stamping face sheets, not routing; finished the same as face.
   5. Top and bottom edges: Flush closures, integral with face sheet construction.
   6. Hardware reinforcement: Concealed within door construction.
   7. Number of hinges: 3 hinges per jamb for doors less than 7 feet (2135 mm) tall; 4 hinges per jamb for doors 7 feet (2135 mm) and taller. Satin Chrome or Brushed Nickel Hinge Finish for all hinges.

9. Sizes: Nominal sizes indicated on drawings, adjusted to fit specified frame type.

C. Doors: Insulated metal; Masonite Sta Tru HD - Insulated Metal Door.
   1. Face sheets: Minimum 22 gage (0.7 mm) thickness.
   2. Core: Polyurethane, foamed in place, without voids.
   3. Finish: Factory primed with two part epoxy/polyester primer.

D. Door, Sidelight, and Transom Glazing: Dual-pane insulating units.
   1. Outer and inner pane of 1/8 inch (3 mm) thick clear tempered glass, sealed airspace, total unit thickness 1/2 inch (13 mm).

E. Glazing Stops:
   1. For factory-glazing: Flush profile wood or steel integral stop assembly.
   2. Patio doors: Two-piece steel stops, mounted flush with door faces, removable for glazing replacement.

2.4 FRAME COMPONENTS

A. Steel Door Frames: Two-piece split-jamb adjustable metal frames; Adjustable Fit Steel Frame.
   1. Material: Galvanized steel conforming to ASTM A 653/A 653M, commercial quality, with A40 coating.
   2. Base jamb component: 16 gage (1.5 mm).
   3. Closure jamb component: 22 gage (0.9 mm).
   4. Base jamb and door pre-hung, with 3-piece closure jamb.
   5. Profile: Double-rabbeted for 1-3/4 inch (44 mm) door thickness, 5/8 inch (16 mm) high stop with channel recess for weatherstrip.
   6. Interlocking base and closure profiles for 1/2 inch (13 mm) throat dimension adjustment.
   7. Corners: Hairline mitered joint at intersections of head and jambs.
   8. Provide separate steel trim by frame manufacturer.
   10. Hardware preparation:
      a. Universal deadbolt preparation and other hardware as indicated.
      b. Integral hinge reinforcement.
   11. Weatherstrip: Manufacturer's standard vinyl covered magnetic and compression type weatherstrip, installed in channel recess at head and jambs. Q-LON QEDB 825 Door Seal weatherstrip, Weathr-Stop Profile 3210 Door Bottom
   12. Finish: Factory dry-powder primer finish.

A. Wood Frames (as an Alternate to the Adjustable Steel Frame indicated above) Provide Equivalent Hardwood Frame and Jamb System with Hardware Prep and Weatherstrip as indicated above.

B. Hinges: Manufacturer's proprietary hinges, 4 inches by 4 inches (100 by 100 mm) by 0.090 inch (2.3 mm) leaf thickness.
   1. Type: Spring-loaded pin.
   4. Finish: Dull chrome (US3).
   8. Provide one hinge for each door reinforcement location.

C. Thresholds: Extruded aluminum, mill finish with safety ribs, complying with requirements of ADA; ribbed extruded vinyl sweep across door bottom; provide threshold for each frame.

2.5 FINISHING

A. Steel:
   1. Treat steel surfaces with chemical treatment to promote paint adhesion.
   2. Factory Primer Finish: Meet requirements of ANSI A224.1 and ISDI 106.

PART 3 EXECUTION

3.1 EXAMINATION

A. Have installer verify that project conditions are acceptable before beginning installation of frames; verify that completed openings to receive frames are of correct size and thickness.

B. Correct unacceptable conditions before preceding with installation.

3.2 INSTALLATION

A. Install frames in accordance with manufacturer's instructions, approved shop drawings, and requirements of ISDI 102; in addition, install frames for fire-rated openings in accordance with requirements of NFPA 80.
B. Installation of door hardware is specified in Section 08710.
C. Field finishing of factory-primed doors and frames is specified in Section 09900.

END OF SECTION

SECTION 081480

HARDBOARD PANEL WOOD DOORS

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hardboard faced wood doors.

1.2 REFERENCES

A. American National Standards Institute (ANSI) Al 35.4: Basic Hardboard.

B. National Wood Window and Door Association (NWWDA) IS 1. 1: Industry Standard for Wood Flush Doors.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300:
   1. Product Data: Manufacturer's descriptive data and product details.
   2. Samples: Physical door sample for each type required, minimum 6 inches by 6 inches, showing edge, core and faces.

B. Provide a 2 year guarantee.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store doors upright with at least ¼ inch between doors, in protected, dry area.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Wood Doors 6'-8 :
   1. Type: NWWDA IS1.1, hollow core.
   2. Profile: Multi panel design die formed from single sheet of hardboard. 2 Panel Design
   3. Grade: NWWDA Good Grade.
   4. Facings: Hardboard; ANSI A135.4, Type S25, untempered, 1/8 inch thick.
   5. Stiles: Wood; medium density fiberboard will not be allowed.

B. Sliding Bi-Pass Doors: 6'-8" 1/8" thick tempered hardboard panel with top and bottom tracks and LX panel backing.

C. Bi-Fold Doors: 6'-8" Provide Hardboard Panel type complete with all required hardware.
   1. Type: NWWDA IS1.1, hollow core.
   2. Profile: Multi panel design die formed from single sheet of hardboard.
   3. Grade: NWWDA Good Grade.
   4. Facings: Hardboard; ANSI A135.4, Type S25, untempered, 1/8 inch thick.
   6. Stiles: Wood; medium density fiberboard will not be allowed.

   D. Solid Core Doors:
      1. 8ft. doors, 1 ¾" thick, (design as indicated on Interior Design Drawings) at Clubhouse- minimum two year guarantee.
      2. Provide 6'-8" Solid Core Doors at Bedrooms and Laundry Room.

E. Frame:
   1. Interior doors: Paint grade softwood.

F. Finish: Pre-finished white.

2.2 FABRICATION

A. In accordance with NWWDA IS1.1,

B. Prepare doors and frames to receive hinges specified in Section 08710.

C. Install doors in frames with hinges attached.

D. Provide removable frame spreader attached to bottom of frame.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, condition doors to average humidity which will be encountered after installation.

3.2 INSTALLATION

A. Install doors plumb and level.

B. If field fitting for height is required, cut bottom edge only; maximum 3/8 inch. Do not cut doors down to opening sizes smaller than those for which they were manufactured.

C. Install door hardware in accordance with Section 08710.

D. Ensure that doors operate freely.

E. Installation Tolerances:
   1. Maximum diagonal distortion: ¼ inch, measured with straight edge from corner to corner.

END OF SECTION

SECTION 08 16 13

FIBERGLASS CLAD WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fiberglass-clad doors with factory glazing.

1.2 PERFORMANCE REQUIREMENTS

A. Design and Performance Requirements:
   1. Units shall be designed to comply with 101/I.S.2-97 and 101/I.S. 2/NAFS-02 (SGD-R40) rating.
   2. Air leakage shall not exceed 0.30 cfm per square foot of frame when tested at 1.57 psf according to ASTM E 283.
   3. No water penetration when tested at 6.0 psf according to ASTM E 547.
   4. Units shall be designed to comply with ASTM E330 for structural performance when tested at the following pressures: (+/-60 psf)

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood door indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:
   1. Mullion details, including reinforcement and stiffeners.
   2. Joinery details.
   3. Expansion provisions.
   4. Flashing and drainage details.
   5. Glazing details.

C. Samples: For door components required, prepared on Samples of size indicated below.
   1. Main Framing Member: 12-inch-long, full-size sections of extrusions with factory-applied color finish.
   2. Glazing: 12 inch x 12 inch sample of each type of glazing specified.
   3. Architect reserves the right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of wood doors. Test results based on use of down-sized test units will not be accepted.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to wood doors manufacturer for installation of units required for this Project.

B. Source Limitations: Obtain wood doors through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of wood doors and are based on the specific system indicated.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   1. Provide AAMA or WDMA-certified wood doors with an attached label.

E. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify wood door openings by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating wood doors without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood doors that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Failure to meet performance requirements.
   2. Structural failures including excessive deflection.
   3. Water leakage, air infiltration, or condensation.
   4. Faulty operation of movable sash and hardware.
   5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   6. Insulating glass failure.

B. Warranty Period: 10 years from date of Substantial Completion.

C. Warranty Period for Glass: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Therma-Tru
   2. Wayne Dalton
   3. Jeld-wen

2.2 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with door members, cladding, trim, hardware, anchors, and other components. Cadmium-plated steel fasteners are not permitted.
   1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

B. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel anchors, clips, and accessories are not permitted.

C. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel reinforcing members are not permitted.

D. Installation Brackets: 6-3/8 inches; 9-3/8 inches; 15-3/8 inches.

2.3 GLAZING

A. Low-E-Coated, Clear Insulating Glass:
   1. Provide dual pane glass units that comply with safety glazing requirements.
   2. U-factor and SHGC: To be determined.

B. Glazing System: Provide manufacturer's standard glazing system that produces weathertight seal.

2.4 FABRICATION

A. General: Fabricate doors, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance grade indicated. Include a complete system for assembling components and anchoring doors.

B. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches, glaze doors in the factory where practical and possible for applications indicated. Comply with requirements in Section 08 80 00 – Glazing and with AAMA/NWWDA 101/I.S.2.

C. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

2.5 FINISH

A. Exterior: As selected by Architect.

B. Interior: As selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturers written instructions for installing doors, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.4 PROTECTION AND CLEANING

A. Protect doors surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor doors surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants.

B. Clean exposed surfaces immediately after installing doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames.
   2. Fire-rated access doors and frames.

1.2 SUBMITTALS

A. Product Data: Manufacturer's literature for each type of access door indicated.

B. Coordination Drawings: Drawn to scale and coordinating access door and frame installation with ceiling support, ceiling-mounted items, and concealed Work above ceiling.

C. Samples: Submit manufacturer's standard size sample each exposed finish.

D. Schedule: Door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.3 QUALITY ASSURANCE

A. Fire-Rated Access Doors and Frames: Units shall comply with NFPA 80 and labeled and listed by UL.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Steel Sheet:
   1. Hot-Rolled: ASTM A 569, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled.
   2. Cold-Rolled: ASTM A 366, Commercial Steel (CS), or ASTM A 620, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
      a. Electrolytic zinc-coated steel sheet, complying with ASTM A 591, Class C coating, may be substituted at fabricator's option.

C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304; with minimum sheet thickness indicated representing specified thickness according to ASTM A 480.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum panels indicated.

E. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to

normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide sound foundation for field-applied topcoats despite prolonged exposure.

2.2 ACCESS DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Bilco Company
   2. Precision Ladders
   3. J. L. Industries, Inc.
   4. Karp Associates, Inc.
   5. Larsen's Manufacturing Company.
   6. Milcor Limited Partnership.
   7. Nystrom Building Products Co.

B. Flush Access Doors and Frames:
   1. Style: As approved by Architect.
   2. Material: Prime-painted steel sheet. Provide stainless steel at locations subject to moisture.
   3. Door: Minimum 14 gage thick sheet metal, set flush with exposed face flange of frame.
   4. Size: Refer to drawings.
   5. Frame: Minimum 16 gage sheet metal.
   6. Hinges: Spring-loaded concealed pin type.
   7. Lock: Flush screwdriver-operated steel cam.

C. Fire-Rated Flush Access Door and Frame with Concealed Flanges :
   1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
   2. Fire-Resistance Rating: Not less than 1-hours.
   3. Size: Refer to Drawings.
   4. Metallic-Coated Steel Sheet for Door: [Nominal 0.040 inch (1.02 mm), 20 gage] <Insert thickness>.
      a. Finish: Factory prime.
   5. Frame Material: Same material, thickness, and finish as door.
   6. Hinges: Manufacturer’s standard.
   7. Hardware:
      a. Lock. Mortise cylinder.
         1) Lock Preparation: Prepare door panel to receive.
   8. Location: Ceiling access from alternating tread device to roof hatch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install access doors flush with adjacent finish surfaces or recessed to receive finish material.

D. Adjust doors and hardware after installation for proper operation.

END OF SECTION

SECTION 083618

SECTIONAL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES: Residential Metal Overhead Doors.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete: Prepared opening in concrete. Execution requirements for placement of anchors in concrete wall construction.

B. Section 04810 - Unit Masonry Assemblies: Prepared opening in masonry. Execution requirements for placement of anchors in masonry wall construction.

C. Section 05500 - Metal Fabrications: Steel frame and supports.

D. Section 06100 - Wood Blocking and Curbing: Rough wood framing and blocking for door opening.

E. Section 07900 - Joint Sealers: Perimeter sealant and backup materials.

F. Section 08710 - Door Hardware: Cylinder locks.

G. Section 09900 - Paints and Coatings: Field painting.

H. Section 16130 - Raceway and Boxes: Empty conduit from control station to door operator.

I. Section 16150 - Wiring Connections: Electrical service to door operator.

1.3 REFERENCES

A. ANSI/DASMA 108 - Standard Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference

B. UL: Underwriters Laboratories, Inc.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.
1. Design pressure to meet Local Requirements

B. Wiring Connections: Requirements for electrical characteristics.
1. 115 volts, single phase, 60 Hz.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

D. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

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

B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Protect materials from exposure to moisture until ready for installation.

C. Store materials in a dry, ventilated weathertight location.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 WARRANTY

A. Traditional Steel Collection 180/181/185 Series Insulated. Warranty: 20 year limited against splitting and cracking, 10 year on hinge and track and all other components for 1 year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121 Bus., Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 929-3667. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com.

B. Raynor Doors - Traditions Series
C. Clopay Doors – Classic Premium Series

D. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 RESIDENTIAL METAL OVERHEAD DOORS

A. Insulated Steel Sectional Overhead Doors: Thermacore Model 296 Series Insulated Steel Doors by Overhead Door Corporation.
   1. Door Assembly: High tensile strength steel construction.
      a. Size: As indicated on the Drawings.
      b. Panel Thickness: 2 inches (51 mm) nominal.
      c. Panel Style: tongue in groove.
         1) V5 Panel, 185 Series.
      d. Exterior Steel: Residential grade high strength hot-dipped galvanized steel with an embossed simulated wood grain texture. 26 gauge (.0183) nominal.
      e. Insulation: Polystyrene.
      f. Thermal Values: R-value of 9.31.
      g. Windload Design: Provide to meet the Design/Performance requirements specified.
      h. Finish/Color: Two coat baked-on polyester. Color as follows:
         1) White.
      i. Hardware: Standard garage door hardware.
      j. Lock:
         1) Interior mounted slide lock.
         2) Optional keyed lock.
      k. Bottom fixture: DASMA 103 tamper resistant fasteners.
      l. Weatherstripping: Extruded PVC bulb-type strip at bottom.
      m. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
      n. Nylon rollers.
      o. Manual Operation.
      p. Electric Openers:

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until openings and substrates have been properly prepared.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

C. Verify electric power is available and of correct characteristics.

D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install overhead doors, track and openers in accordance with approved shop drawings and the manufacturer's printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service with Section 16150.

3.4 CLEANING AND ADJUSTING

A. Adjust door assembly to smooth operation and in full contact with weatherstripping.

B. Clean doors, frames and glass.

C. Remove temporary labels and visible markings.

3.5 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

B. Protect installed products until completion of project.

C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION

SECTION 08 41 13

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior entrances.
2. Exterior and Interior storefront systems.

1.2 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:
1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Wind Loads: Design and size entrance and storefront systems, including anchorage, capable of withstanding dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ANSI/ASTM E330
1. Deflection of framing members in a direction normal to wall plane is limited to L/175 of clear span or 3/4 inch, 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 of wind for relevant exposure category.

D. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
1. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.
2. Provide a minimum 1/16-inch clearance between members and operable windows and doors.

E. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

F. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft.

G. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of

20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 10 lbf/sq. ft. Water leakage is defined as follows:

1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

H. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.

J. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

K. Performance - Aluminum Doors (Swinging): Resistance to corner racking shall be tested by the Dual Moment Load test as follows:

1. Test section shall consist of standard top door corner assembly. Side rail section shall be 24 inches long and top rail section 12 inches long.
2. Anchor "top rail" positively to test bench so that corner protrudes 3 inches beyond bench edge.
3. Anchor a lever arm positively to side rail at a point 19 inches from inside edge of top rail. Attach weight support pad at a point 19 inches from inner edge of side rail.

Edit the following for door selected: Narrow stile doors: 155 pounds, Medium and Wide stile doors: 200 pounds

4. Test section shall withstand a minimum load of 200 pounds on the lever arm before reaching the point of failure, which shall be considered a rotation on the lever arm in excess of 45 degrees.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s literature for each product specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings:

1. Entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, attachments to other work and glazing details.
2. Entrance systems: Submit hardware schedule and indicate operating hardware types, quantities, and locations.

C. Samples:

1. Submit 2 samples of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
2. Samples will be reviewed by Architect for color and texture only.
3. Cutaway Sample: Architect reserves the right to require samples of typical fabricated sections, showing joints, exposed fastenings (if any), quality of workmanship, glazing, flashing and drainage, expansion provisions, structural sealant joints, hardware and accessory items, before fabrication of the Work proceeds. Samples shall be made from minimum 6-inch lengths of full-size components.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.
   1. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain entrance and storefront systems, including finishes, used for this project through one source from a single manufacturer. Operable windows used in conjunction with these systems shall be manufactured by a company whose products are compatible with the specified entrances and storefront.

C. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

D. Regulatory Requirements:
   1. ANSI A117.1 "Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People."
   2. Public Law 101-336 "The Americans with Disabilities Act of 1990 (ADA).
   3. ADA Accessibility Guidelines (ADAAG).

1.5 PROJECT CONDITIONS

A. Field Measurements:
   1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
   2. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions to ensure proper fit.

1.6 WARRANTY

A. Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including, but not limited to, excessive deflection.
   2. Adhesive or cohesive sealant failures.
   3. Failure of system to meet performance requirements.
   4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   5. Failure of operating components to function normally.

B. System Warranty Period: 5 years

C. Finish Warranty: Warrant anodized coating against excessive fading, excessive non- uniformity of color or shade, cracking, peeling, pitting or corroding (all within the limits defined). Warranty shall include replacement at no charge (material and labor) within 5 years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Old Castle
2. YKK AP
3. Kawneer Company, Inc.
4. EFCO Corporation.
5. Arcadia
6. U.S. Aluminum.
7. Southwest Aluminum Systems, Inc.
8. Vistawall Architectural Products.

2.2 MATERIALS

A. Aluminum: Extruded 6063 T5 aluminum alloy (ASTM B221 - Alloy G.S. 10aT5), complying with the requirements of standards indicated below.
1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211.
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.

C. Glazing: As specified in Section 088100– Glazing.

D. Glazing Gaskets: Elastomeric extrusions as required to provide specified performance. Vinyl (PVC) glazing gaskets are not acceptable.

E. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements. Wood is not an acceptable material for setting blocks or shims.

F. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

G. Sealants and joint fillers: As specified in Section 079200 – Joint Sealants and Caulking.

H. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.3 COMPONENTS

A. Doors: Provide manufacturer's standard 1-3/4-inch- thick glazed doors with minimum 0.125-inch- thick, extruded tubular rail and stile members. Corners shall be mechanically fastened with reinforcing brackets or deep penetration and fillet welded. .
   1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.

B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

C. Operable Windows: shall be Old Castle 2000 Series Projecting Hopper or equal.
   1. Perimeter frame depth shall be 2".
   2. Members shall be of thermal-break design, achieving thermal separation between interior and exterior surfaces.
   3. Sash operation shall be BHPI (bottom-hung project in).
   4. Window shall operate by means of Manufacturer's standard hardware.
   5. Finish of all hardware components shall be standard, as selected from Window Manufacturer's stock range.
   6. Window shall accept insulating glass units of 1" overall thickness.
   7. Window shall be prime-sealed, using butyl glazing tape with integral shim to prevent over-compression of tape.
   8. All assembly screws shall be #400 stainless steel.
   9. Insect Screens: Provide insect screens to cover portion of window normally operating. Screen bar shall be tubular extruded aluminum, finished to match adjacent profiles. Mesh shall be 18 x 14 fiberglass.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Reinforce members as required to retain fastener threads.
   2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials and of type recommended by manufacturer.

G. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:
   1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.

H. Accessories: Provide end-dams, water deflectors and other accessories as required for proper drainage.

I. Hardware: Finish Hardware shall be furnished by manufacturer.

2.4 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. When shop fabricated, clearly mark components to identify their locations in Project according to Shop Drawings.

1. Reinforce the Work as necessary for performance requirements, and for support to the structure.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Storefront: Fabricate framing in profiles indicated on Drawings and in accordance with manufacturer's approved details.
1. Reinforce internally with steel channel shapes as indicated, or as necessary to support the required loads. Secure vertical steel at head and sill as necessary for structural performance.

I. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
1. Exterior Doors: Provide compression weather stripping at fixed stops.

J. Flashings and Miscellaneous Trim:
1. Provide interior sills, exterior sill (or subsills) with end dams, closures, flashings, trim and other elements in conjunction with or adjacent to storefront system as required for watertightness and aesthetics. If sill frame does not provide means for conducting water out of the aluminum frame systems, then suitable flashings to ensure that water is conducted out of system shall be provided.
2. Fabricate miscellaneous trim from 0.060-inch-thick minimum aluminum (break metal) finished to match other components, except fabricate interior and exterior sills (or subsills) from 0.075-inch-thick minimum extruded aluminum (unless the sill or subsill is supporting the weight of the system and then a 0.125-inch thick minimum extruded aluminum shall be provided).
3. Flashings and sill can, in conjunction with mechanically fastened end dams and/or water diverters shall direct water entering the system to the outside of the building and shall not depend solely upon sealants.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to 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.

C. Class I, Color Anodic Finish: AA-M12C22A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.
1. Color: To be selected by Owner.

2.6 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise recommended by manufacturer. Comply with requirements of Section 079200 - Joint Sealants and Caulking.

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
   1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

G. Glazing: Comply with requirements of Section 088100 - Glazing unless otherwise indicated.

H. Install perimeter sealant to comply with requirements of Section 079200 - Joint Sealants and Caulking, unless otherwise indicated.

I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
   1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.
   2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
   3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to test the storefront system for water leaks in accordance with AAMA 501.2.94.

B. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

3.4 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.5 CLEANING

A. Clean aluminum surfaces promptly after installation of frames, exercising care to avoid damage of the protective coating.

B. Remove excess glazing and sealant compounds, dirt, and other substances.

3.6 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08 53 13

VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Furnishing and installing residential vinyl windows complete with hardware and related components as shown on Drawings and specified in this Section.

B. Glass and Glazing:
   1. Provide STC 34 rated windows at following units: [No. ___] [No. ___] [No. ___].
   2. Provide STC 34 rated windows at units located [_____].
   3. Provide STC 31 rated windows at [units facing courtyards].
   4. Provide STC 29 rated windows at [remaining windows].

1.2 TESTING AND PERFORMANCE REQUIREMENTS

A. Test Unit:
   1. Air, water and structural test unit sizes and configurations shall conform to requirements set forth in AAMA/WDMA/CSA 101/I.S.2/A440.

B. Test Procedures and Performance:
   1. Windows shall conform to AAMA/WDMA/CSA 101/I.S.2/A440.
      a. Minimum Performance Class: LC.
      b. Minimum Performance Grade: 30.
      c. In addition, following specific performance requirements shall be met.
   2. Air Infiltration Test
      a. With window sash closed and locked, test the unit in accordance with ASTM E283 at static air pressure difference of 1.6 psf.
      b. Air infiltration shall not exceed 0.18 cfm per foot of perimeter crack length.
   3. Water Resistance Test
      a. With window sash closed and locked, test unit in accordance ASTM E547 static air pressure difference of 4.50 psf.
      b. There shall be no uncontrolled water leakage.
   4. Uniform load structural test
      a. With window sash closed and locked, test unit in accordance with ASTM E330 at a static air pressure difference of 45 psf negative pressure.
      b. At the conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or operating mechanism nor any other damage which would cause the window to be inoperable.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of following:
   1. Northern Climate Zone: 0.30 Btu/sq. ft. x h x deg F.
   2. North-Central Climate Zone: 0.32 Btu/sq. ft. x h x deg F.
   3. South-Central Climate Zone: 0.35 Btu/sq. ft. x h x deg F.
   4. Southern Climate Zone: 0.60 Btu/sq. ft. x h x deg F.

1.3 QUALITY ASSURANCE

A. Provide test reports from AAMA accredited laboratories certifying performance as specified.

B. Provide windows that are NFRC labeled certifying performance as specified.

1.4 SUBMITTALS

A. 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 sections, corner sections, etc.
   2. Shop Drawings: Include locations, elevations, sections, materials, finishes, and attachments.

1.5 WARRANTIES

A. Provide manufacturer's 10 year warranty.

B. Responsible contractor shall assume full responsibility and warrant for two years the satisfactory performance of total window installation which includes that of windows, 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 Specifications and approved shop drawings.

C. Deficiencies due to such elements not meeting Specifications shall be corrected by responsible contractor at contractor's expense during warranty period.

PART 2 – PRODUCT

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of following:
   1. Ply Gem.
   2. Silver Line Building Products by Andersen.
   3. Doers.

2.2 MATERIALS

A. Vinyl: Fabricate extrusions from polyvinyl chloride (PVC).
   1. Exterior Color: Dark Bronze
   2. Interior Color: White or Standard Selection

B. Hardware:
   1. Compliant with applicable accessibility and operating force requirements.
   2. Corrosion-resistant; sized to accommodate sash weight and dimensions.
   3. Locking: Sweep style lock operated from inside only.
   4. Hung Windows: Counterbalance mechanism complying with AAMA 902. Tilt hardware (if indicated) with releasing tilt latch allowing sash to pivot about horizontal axis.
   5. Projected Windows: Gear-type rotary operators complying with AAMA 901 when tested in accordance with ASTM E 405, Method A; operators that function without requiring removal of interior screens or using screen wickets.
   6. Fall Prevention Device (Limiting Device or Opening Control Device): Window manufacturer's ASTM compliant limit device for limiting clear opening to size that will prevent 4 inch sphere from passing through for fall prevention; with manual override release to allow emergency egress or rescue or ventilation. Refer to Drawings.
      a. Emergency Escape (Egress) and Rescue (Ingress) Windows: ASTM F2090 compliant.
      b. Non-Emergency Escape (Egress) and Rescue (Ingress) Windows: ASTM F2006 compliant.

C. Weatherstripping:
   1. PVC bulb seal.

2. Weatherstripping shall be finseal; full perimeter weatherstripping for each operable sash unless otherwise indicated

D. Glass and Glazing:
   1. Low-E-Coated, Clear Insulating Glass:
      a. Provide dual pane glass units that comply with safety glazing requirements.
      b. U-factor: .30 min
      c. Solar Heat Gain Coefficient (SHGC): .25 min

E. Reinforcement: As required to comply with specified structural performance.
   1. Internal frame and sash reinforcement: 6063-T6 aluminum or steel; isolated in separate chamber to inhibit rusting.

2.3 FABRICATION

A. General:
   1. Frame members and sash extrusions shall have minimum wall thickness of 0.062 inch.
   2. Depth of frame and sash shall not be less than 2-1/4 inch.

B. Frame:
   1. Miter and weld frame components.
   2. Slope sill of frame to exterior for positive water drainage.
   3. Install one row of weatherstripping specially designed groove in sill.
   4. Fabricate fixed mullion with tube type reinforcement as required, continuous locking groove, and continuous interlocking leg that captures interlocking leg on sash in closed position.

C. Sash:
   1. Sash components shall be mitered and welded.
   2. Install two rows of weatherstripping in specially designed grooves in sash members.
   3. Install two rows of weatherstripping specially designed groove in sill of sash.
   4. Fabricate sash meeting rail with tube type reinforcement as required and continuous interlocking leg that captures interlocking leg on fixed mullion.

D. Screens (as indicated on Drawings):
   1. Screen frame shall be roll formed aluminum.
   2. Screen mesh shall be an 18 x 16 aluminum or fiberglass mesh.

E. Glazing:
   1. Units shall be set from interior against continuous bead of silicone. Interior glazing retainer shall be extruded vinyl snap-in.

F. Hardware:
   1. Locking hardware shall lock into continuous groove on fixed mullion.
   2. Sash shall operate on counterbalance mechanism.
   3. Fall Prevention Device (Limiting Device or Opening Control Device): Install as integral part of sash or frame.

G. Divider Grilles (False Muntins):
   1. Provide grilles between glass suspended in air cavity.
   2. Grilles: 5/8 inch flat; pattern as indicated on Drawings.
      a. Exterior Color: Refer to Finish Selection Summary, or if not indicated, as selected by Architect.
      b. Interior Color: Refer to Finish Selection Summary, or if not indicated, as selected by Architect.
   3. Fabricate grilles of roll-formed aluminum.

H. Exterior Trim:
   1. Provide integrated exterior trim and J-channel.
   2. Provide brick mold window casing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings are dimensionally within allowable tolerances, plumb, level, clean, provide solid anchoring surface and are in accordance with approved shop drawings.

3.2 INSTALLATION

A. Install windows in accordance with approved shop drawings and manufacturer's written instructions. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Plumb and align window faces in single plane and erect windows and materials square and true without distortion. Anchor windows adequately to maintain positions permanently when subjected to normal thermal and building movement and specified wind loads.

C. Furnish and apply sealant to provide weathertight installation at joints and intersections and at opening perimeters.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
   1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A, by applying same test pressures required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 in Testing and Performance Requirements of this Section.
   2. Testing Extent: Three windows as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation and nominal curing of sealant and glazing componds, but before installation of interior finishes.
   3. Test Reports: Shall be prepared according to AAMA 502.

B. Remove and replace windows where test results indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Adjust operating sashes and hardware for tight fit at contact points and weatherstripping for smooth operation and weathertight closure.

3.5 PROTECTION AND CLEANING

A. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances. Leave exposed surfaces and joints clean or smooth. Remove labels and shipping pads.

B. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written recommendations.

C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 087100

DOOR HARDWARE

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hardware for steel and wood doors and frames.
   2. Thresholds.
   3. Weatherstripping.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. A156.1 - Butts and Hinges.
   2. A156.2 - Bored and Preassembled Locks.
   3. Al 56.5 - Auxiliary Locks and Associated Devices.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300:
   1. Samples: One sample of each hardware item.
   2. Schedule:
      a. Provide information necessary to determine proper selection and function of hardware, including door hand, bevel, thickness, swing and other attributes.
      b. Include product data for each item.
      c. Prepare schedule listing doors according to Drawing door and room numbers.

B. Permanent Keys: Forward directly to Owner; tag and identify with mark corresponding to keying schedule.

l.4 DELIVERY, STORAGE AND HANDLING

A. Pack each item of hardware separately, complete with fasteners, installation instructions, and templates.
B. Mark each container with item number corresponding to number on hardware schedule.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Butt Hinges:
   1. Hager Hinge Co.
   2. McKinney Manufacturing Co.
   3. Stanley Hardware.

B. Acceptable Manufacturers - Locksets and Deadbolts:
   1. Pamex
   2. Kwikset
   3. Falcon Locks

C. Substitutions: Under provisions of Section 01600.

2.2 MANUFACTURED UNITS

A. Butt Hinges Residential Unit Entrance and Unit Interiors:
   1. Type: ANSI A156.1, full mortise, five knuckle, hole in bottom tip for pin removal. Paint Grade.
   2. Size:
      a. 1-3/8 inch thick doors: 3-1/2 x 3-1/2 inches.
      b. 1-3/4 inch thick doors: 4 x 4 inches.
   3. Exterior Entry Doors and Outswinging doors: non removeable pin .

B. Butt Hinges All Common Area and all Other Areas outside of the Residential Units:

1. Type: ANSI A8112, full mortise, five knuckle, two ball bearings, non rising removeable pin (Provide Non Removeable Pin for all storage room doors) with button tip and plug. .
2. Size:
   a. 1-3/4 inch thick doors: 4 x 4 inches.
3. Tamper Resistant Non Removable Pins for all storage room and office doors.

D.. Locksets, Deadbolts, and Cylinders Residential Unit Entrances and Unit Interiors:
1. Passage/Privacy Sets: Pamex or Kwikset Grade 3 – Lever Handle in Accessible Units and at all unit Entry Doors – US15 Finish
2. Deadbolts Pamex or Kwikset , ANSI AI 56.5 Standard duty cylindrical type with 1 inch bolt throw. – US15
3. Keys: Nickel silver; inscribe to identify cylinder manufacturer.
4. Keying:
   a. Key alike, cross key or otherwise key as directed by Owner.
   b. Provide six keys for each lock.
5. Strike plates: Provide latch strike plates with minimum lip projection necessary to protect trim.
6. Strike boxes: Wrought steel.

E. Locksets, Deadbolts and Passage Sets in All Common Area and all Other Areas outside of the Residential Units:
1. Locksets: ANSI AI56.13 Type 4000 Grade 2 – Lever Handle – US15
   Passage Sets/Privacy Sets: Pamex or Kwikset Grade 3 – – Lever Handle – US15 Residential Units/Clubhouse - (Refer to Interior Design Schedule – for Clubhouse Entry and Interior Hardware Design
2. Deadbolts ANSI AI 56.5 Standard duty cylindrical type with 1 inch bolt throw. – US15 Residential Units/ US15 in Clubhouse
3. Keys: Nickel silver; inscribe to identify cylinder manufacturer.
4. Keying:
   a. Key alike, cross key or otherwise key as directed by Owner.
   b. Provide six keys for each lock.
5. Strike plates: Provide latch strike plates with minimum lip projection necessary to protect trim.
6. Strike boxes: Wrought steel

F. Weatherstripping:
1. Head and jambs: Extruded neoprene or silicone type, self adhering.
2. Door bottom: Extruded aluminum housing with neoprene sweep.

G. Threshold: 4 inch wide x ½ inch high aluminum saddle.

H. Door Stops:
1. Wall mounted, screw-in **spring** type with rubber tip, where door swing permits.
2. Where door swing prevent installation of wall stop, use two adjustable hinge pin mounted stops.

I. Door Viewers: 160 degree type.

J. Finishes:
1. Door seal housings: Bronze anodized.
2. Other: US15 finish for all Residential Units – US15 for All Clubhouse Hardware.

K. Keying:
1. As required by Owner. Coordinate with the Owner during submittal process**; 4 keys per entry door.**
2. Separate construction keying is a requirement.

L. Closers:
1. LCN 4040 Series or Norton 9500 (for all entry, vestibule and stairwell doors)
2. LCN 1261 Series or Norton 1600 (for all other interior "public" area doors including office, storage, mechanical, etc.)

M. Exit Devices:
1. Von Duprin 98 Touchbar Series or Cal Royal 9800 Series (In EO and L configurations)
2. Von Duprin 3527A-F or Cal Royal 9860 Surface Mount Vertical Rod Exit Devices

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install hardware in accordance with approved schedule and manufacturer's instructions.
B. Install mortise items flush with adjacent surfaces.
C. Install locksets and trim after finish painting.
D. Secure strike plates for deadbolts with minimum 2-1/2 inch long wood screws.

E. Hardware Locations: Conform to applicable accessibility code for locating items.

1. Hardware mounting heights shall confirm to the following unless otherwise indicated on the Drawings:

Hinge (Butt or Pivot)	Top – 7" From head to top of Hinge leaf. Bottom – 11" From bottom of hinge to finished floor. Intermediates – Equal distances between top and bottom hinges.
Knob (Locks or Latches)	38" From finished floor to center of knob.
Deadlocks/Deadbolts	44" From finished floor to center of cylinder.
Deadbolt	46" Deadbolt – Interior thumb lock only.
Doorpulls, Pushplates & Pushbars	45" From finished floor to centerline.
Doorviewers (wide angle)	62" From finished floor to centerline.

3.2 PROTECTION

A. Remove or protect hardware until painting is completed.

3.3 ADJUSTING

A. Test and adjust hardware for quiet, smooth operation, free of sticking, binding, or rattling.

3.4 DOOR HARDWARE SCHEDULE

Refer to Door Schedule on Drawings for Hardware Groups

Provide Extra Stock of all Hardware: 6 each of all hinges, stops, viewers, safety chains, kick plates, thresholds and weatherstripping:

6 each of all types passage sets and locksets

END OF SECTION

SECTION 088100

GLAZING

1.1 GENERAL

A. System Performance Requirements: Provide glazing systems capable of withstanding normal thermal movement, wind loading, and impact loading, without failure including loss or glass breakage attributable to: defective manufacture, fabrication, and installation; deterioration of glazing materials; and other defects in construction.

1. Glass Design: Provide glass lites in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria based on analysis of Project loads and in-service conditions:
    a. Minimum glass thickness, nominally, of lites in exterior walls is 6.0 mm (0.23 inch).
    b. Minimum glass thicknesses of lites composed of annealed or heat-treated glass are selected so the worst-case probability of failure does not exceed the following:
        1) 8 lites per 1000 for lites set vertically or not over 15 degrees of vertical and under wind action.

B Glazing Publications: Comply with published recommendations of glass product manufacturers, "FGMA Glazing Manual," and publications of AAMA, LSGA, and SIGMA as applicable to products indicated, except where more stringent requirements are indicated.

C Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category H materials.

1.2 PRODUCTS

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

1. Ford Class Division
2. LOF Glass, Inc.
3. PPG Industries, Inc.

B. Sizes: Fabricate glass of thickness indicated and to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

C. Float Glass: ASTM C 1036, Type I, Class as indicated below, and Quality q3.

1. Class 1 (clear) unless otherwise indicated.

D. Heat-Treated Float Glass Products: As follows:

1. Uncoated, Clear, Heat-Treated Tempered Float Glass: ASTM C 1048, Condition A, Type 1, Class 1, Quality q3, kind as indicated below:
    a. Kind FT where indicated.

E. Elastomeric Glazing Sealants: Products complying with ASTM C 920

1. Additional Movement Capacity: Provide products, when tested per ASTM C 719, with the capability to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

F Patterned Glass: ASTM C 1036, Type II, Class 1, Form 3, Quality q8, Finish fl, of pattern indicated in Rolled Glass Product Data Sheet at the end of this Section.

G Tempered Patterned Glass: ASTM C 1048, Kind FT, Type H, Class 1, Form 3, Quality q8, Finish fl, of pattern in Patterned Glass Product Data Sheet at the end of this Section.

H. FireLite (TGP Industries) Fire Rated Glazing 3/16 Standard Grade Glass. UL approved

Fire Ratings (with UL and WHI classification marking):

20 minute: Approved listing at 1296 sq. in. visible lite
(max. width 54", max height 54"
45 minute: Approved listing at 1296 sq. in. visible lite
(max. width 54", max height 54"
60/90 Minute: Approved listing at 100 sp. in. visible lite
(max. width 10", max. height 33")

H Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape, with or without spacer rod as recommended by tape and glass manufacturers for application indicated, and complying with AAMA 800 for products indicated below:

1. AAMA8O4.1.

I Expanded Cellular Glazing Tape: Closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, and complying with AAMA 800 for product 810.5.

J. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

K. Dense Compression Gaskets: Molded or extruded, gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTMC 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

L. Miscellaneous Glazing Materials: 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.

M. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with

edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing publications as required to comply with system performance requirements.

1. Clean cut or fiat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

1.3 EXECUTION

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 "FGMA Glazing Manual."

B. Protect glass from edge damage during handling and installation.

C. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

D. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

E. Lock Strip Gasket Glazing: Comply with ASTM C 716 and gasket manufacturer s printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

F. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter.

G. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

H. 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

SECTION 09 29 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum wallboard.
   2. Tile backing panels.
   3. Exterior gypsum sheathing.

1.2 SUBMITTALS

A. Product Data: For each type of gypsum product, joint, finish and accessories indicated.

B. Samples:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Sound Transmission Characteristics: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

C. Comply with applicable specification recommendations of GA-216 and GA-600 as published by the Gypsum Association.

1.4 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. Stack gypsum panels flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or damage metal corner beads and trim.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 CEILING SUSPENSION SYSTEMS

A. Ceiling Support Materials and Systems: Comply with ASTM C 754 for conditions indicated.
   1. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

2.2 GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.
   1. Regular Type:
      a. Thickness: 5/8 inch or 1/2 inch, unless otherwise indicated.
      b. Long Edges: Tapered.
   2. Type X:
      a. Thickness: 5/8 inch.
      b. Long Edges: Tapered.
   3. Type C:
      a. Thickness: 5/8 inch.
      b. Long Edges: Tapered.
   4. Water-Resistant Gypsum Backing Board: ASTM C 630, 5/8 inch, Type X.
      a. Water resistant gypsum board is not acceptable as a tile backing substrate.
   5. Exterior Densglass Gold Bond gypsum sheathing
      a. Thickness: 5/8 inch.
      b. Long Edges: Tapered.
   6. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
      a. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
      b. Long Edges: Tapered.
   7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   8. Gypsum Board and Related Products:
      a. American Gypsum Co.
      b. G-P Gypsum Corp.
      c. National Gypsum Company.
      d. United States Gypsum Co.
      e. James Hardie Gypsum
      f. Pabco Gypsum
      g. Certainteed

C. Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178, 5/8 inch, Type X.
      a. Product: Subject to compliance with requirements, provide "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp.

2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: A gypsum core soffit panel with additives to enhance the sag resistance of the core; surfaced with water repellant paper on front, back, and long edges; and complying with ASTM C 931 and C 1396 (Gold Bond Brand Exterior Soffit Board).
   a. Thickness: 5/8 in.
   b. Width: 4 ft
   c. Length: 8 ft. through 12 ft.
   d. Edges: Beveled Taper (Sta-Smooth Edge)

2.4 TRIM ACCESSORIES

A. Trim: ASTM C 1047.
   1. Material: Galvanized steel sheet
   2. Shapes:
      a. Cornerbead:
         1) Shape: L shape, similar to Dur-a bead corner bead by USG
         2) Use at outside corners, unless otherwise indicated.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges unless otherwise indicated.
      c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use where indicated.
      e. Expansion (Control) Joint: One piece formed with V shaped slot, with removable strip covering slot opening, use where indicated.

2.5 JOINT TREATMENT MATERIALS

A. Joint Materials: Comply with ASTM C 475
   1. Joint Tape:
      a. Interior Gypsum Wallboard Living/Bedrooms: Paper.
      b. Interior Gypsum Wallboard Baths/Kitchens/Laundry: Fiberglass Mesh
      c. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

B. Joint Compound for Interior Gypsum Wallboard: Use Standard Joint Compound for Living/Bedroom Areas, Use Mold Resistant Joint Compound for Baths/Kitchens/Laundry. For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
   4. Finish Coat: Touch up as required.

C. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.6 TEXTURE FINISHES

A. Unit and Clubhouse wall finish: smooth finish.

B. Unit and Clubhouse ceiling finish: medium texture to be selected by Owner.

C. Submit sample of application for Owner approval.

2.7 ACCESSORIES

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Wood Framing: ASTM C 1002, Type W for fastening to wood framing, unless otherwise indicated.
   2. Steel framing: Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Isolation Strip at Exterior Walls:
   1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 LIGHTGUAGE COMPONENTS

A. Direct Furring and Channels:
   1. Screw to wood framing.
   2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

3.3 APPLYING AND FINISHING PANELS - GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and 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. Do not make joints other than control joints at corners of framed openings.

E. Attach gypsum panels to framing provided at openings and cutouts.

F. Form control and expansion joints with space between edges of adjoining gypsum panels.

G. Unless 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. in area.

H. Fit gypsum panels around ducts, pipes, and conduits.

I. Where partitions intersect 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- wide joints to install sealant.

J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
   1. Space screws a maximum of 12 inches o.c. for vertical applications.

L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

M. Attachment to Wood Framing:
   1. Install gypsum panels over wood framing, with floating internal corner construction.

N. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.4 PANEL APPLICATION METHODS

A. Single-Layer Application:
   1. Ceilings:
      a. Install across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panel’s not less than one framing member.
      b. Apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. Partitions/Walls: Apply gypsum panels vertically (parallel to framing), to 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, unless otherwise indicated or required by fire-resistance-rated assembly.
   3. Z-furring members: Apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multi-Layer Applications:
   1. Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. Partitions and Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. Fastening Methods: Fasten base layers and face layers separately to supports with screws or fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at wet locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.
   1. Space fasteners 6 inches o.c. Drive fasteners flush with coated surface. Do not countersink.

3.5 INSTALLATION - TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings, as recommended by board manufacturer’s recommendations and in accordance with ASTM C840.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges.
   3. L-Bead: Use where indicated.
   4. U-Bead: Use at exposed panel edges.
   5. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Provide finish of gypsum board surfaces in accordance with the Gypsum Association "Recommended Specification: Levels of Gypsum Board Finish" as follows:
   1. Level 0 Temporary Construction: No taping, finishing, or accessories required.
   2. Level 1 Fire Taping at plenum areas above ceiling, in attics, in areas where the assembly will be concealed or in building service corridors and other areas not normally open to public view.
      a. Joints and interior angles shall have tape embedded in joint compound.
      b. Surface shall be free of excess joint compound.
      c. Tool marks and ridges are acceptable.
   3. Level 2 Water resistant gypsum board for storage areas, or other similar area where surface appearance is not of primary concern. (Storage, riser rooms)
      a. Joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating joint compound over joints and interior angles.
      b. Fastener heads and accessories shall be covered with a coat of joint compound.
      c. Surface shall be free of excess joint compound.
      d. Tool marks and ridges are acceptable.
      e. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
      f. Finish with one coat of paint to seal drywall.
   4. Level 3 Appearance areas to receive heavy or medium texture (spray or hand applied) finishes before final painting, or where heavy grade wallcoverings are to be applied as final decoration.

This level of finish is not to be used where smooth painted surface or light to medium wallcoverings are to be applied. (Unit ceilings)

5. Level 4 Appearance areas to receive flat paints, light texture, or where backed wallcoverings are to be applied. This level of finish is not to be used where gloss, semi-gloss and enamel paints are to be applied. (Unit and Clubhouse walls)
6. Level 5 Appearance areas to receive gloss, semi-gloss, enamel, or nontextured flat paints or where severe lighting conditions occur.
    a. Joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over flat joints and one separate coat applied over interior angles.
    b. Fastener heads and accessories shall be covered with 3 separate coats of joint compound.
    c. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface to fill imperfections in the joint work, smooth the paper texture and provide a uniform surface for decorating. Excess compound shall be immediately sheared off, leaving a film of skim coating compound completely covering the paper.
    d. The surface shall be smooth and free of tool marks and ridges.
    e. Surface to be coated with Drywall Primer as specified herein prior to application of texture.
    f. Untextured surfaces to be coated with Drywall Primer prior to application of final finishes as specified in Section 09 91 00 - Painting.

Locations: Verify locations to receive various Levels of finishing with Owner prior to commencing work.

3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup, 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 to prevent damage according to texture finish manufacturer's written recommendations.

3.8 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
    1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
    2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 31 00

CERAMIC TILE

PART 1 - GENERAL

1. 1 SUMMARY

A. Section Includes:
   1. Ceramic tile floor and base. (Refer to Interior Design Drawings)
   2. Ceramic tile wall finish. (Refer to Interior Design Drawings)

B. Related Sections:
   1. Section 01300 - Submittals
   2. Section 01400 – Quality Requirements
   3. Section 07900 – Joint Sealants
   4. Section 09260 – Gypsum Board Assemblies

1.2 REFERENCES

A. ANSI A1 08.4 – Ceramic Tile Installed with Water Resistant Organic Adhesives
B. ANSI A1 08.5 – Ceramic Tile Installed with Dry Set Portland Cement Mortar or Latex Portland Cement Mortar.
C. ANSI A1 18.4 – Latex Portland Cement Mortar
D. ANSI A1 18.6 – Ceramic Tile Grouts
E. ANSI A1 36.1 – Organic Adhesives for Installation of Ceramic Tile
F. ANSI A1 37.1 – Ceramic Tile
G. TCA - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

A. Product Data:
   1. Product data for each ceramic tile, mortar, grout and other products specified.

B. Samples:
   1. Provide manufacturers standard tile color charts of actual tile to be used for color selection. Also provide accessory pieces (bullnoses, cove bases, etc.) for selection.
   2. Provide cured grout samples showing manufacturers full range of colors, for selection of tile grouts.
   3. Mount tile, adhesive, and grout on 36” x 36” inch plywood panel, representative of pattern, color variations, and grout joint size variation.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in commercial ceramic tile work with five (5) years documented experience.

B. Supplier:
   1. Single Source Responsibility for Ceramic Tile and Accessories – obtain ceramic tile and accessories from single source supplier and from single source manufacturer.
   2. Single Source Responsibility for Mortar and Grout Materials – obtain mortar and grout materials from single source supplier and from single source manufacturer.

C. Perform work in accordance with ANSI A137.1.
D. Conform to TCA requirements for tile maintenance.

1.5 DELIVERY, STORAGE and HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.
B. Prevent damage or contamination to materials by water, freezing, foreign matter and other causes.
C. Handle tile with temporary coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.6 PROJECT CONDITIONS

A. Maintain minimum ambient temperature of 50 degrees Fahrenheit during and after installation.

1.7 STOCK MATERIALS

A. Furnish additional stock materials described below that match the products installed. Package with protective covering for storage purposes and clearly label describing the 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(s) indicated.

PART 2 – PRODUCTS

2. ACCEPTABLE MANUFACTURERS – TILE

A. American Olean Tile Company
B. Dal-Tile Corporation
C. Summitville Tiles Incorporated
D. Substitutions: To requirements of Division 1.

.2.1 ACCEPTABLE MANUFACTURERS - SETTING MATERIALS

A. Custom Building Products
B. Laticrete International Incorporated
C. Mapei
D. Substitutions: To requirements of Division 1.

2.2 MATERIALS

A. Ceramic Wall Tile – (Unit Bath Tub/Shower Surrounds):

1. Nominal Size: 3” x 6” Subway Pattern Base Bid – (6”x6” ALTERNATE BID)
2. Nominal Thickness: 5/16”
3. Surface Finish: Glazed
4. Color: To be selected by Owner from manufacturers standard color selection. Allow for selection of a minimum of three (3) different color tile units.
5. Trim:
   a. Bullnose: Wainscot Cap. Color and finish to match adjacent wall surface.
   b. Base: Coved Base. Color and finish to match adjacent wall surface.
   c. Exterior Corners: Bullnose. Color and finish to match adjacent wall surface.
   d. Internal Corners: Field butted square corners, except with cove base and cap angle pieces designed to member with stretcher shapes. Color and finish to match adjacent wall surface.
   e. Window Sills at tile locations only: Provide Carrera Marble Window Sill.

B. Ceramic Floor Tile (Unit Bathroom Floors):

6. Nominal Size: refer to ID Drawings for Type and location
7. Nominal Thickness: 5/16”
8. Surface Finish: Matte Glazed, slip resistant, stain resistant and impact resistant.
9. Edge Treatment: Cushioned
10. Color: To be selected by Owner from manufacturers standard color selection. Allow for selection of a minimum of three (3) different color tile units.
11. Base Wall Trim: Cove Base, 6” high x 8” wide, color and finish to match floor tile.

C. Ceramic Floor Tile (Public Areas and Unit Entrances or as indicated):

1. Nominal Size: refer to ID Drawings for Type and location
2. Nominal Thickness: 5/16”
3. Surface Finish: Matte Glazed, slip resistant, stain resistant and impact resistant.
4. Edge Treatment: Cushioned

5. Color: To be selected by Owner from manufacturers standard color selection. Allow for selection of a minimum of three (3) different color tile units.
6. Base Wall Trim: Cove Base, 6" high x 8" wide, color and finish to match floor tile.

D. Ceramic Wall Tile (public restroom areas):
1. Nominal Size: As indicated in ID drawings
2. Nominal Thickness: 5/16"
3. Surface Finish: Glazed
4. Color: To be selected by Owner from manufacturers standard color selection. Allow for selection of a minimum of three (3) different color tile units.
5. Trim:
   f. Bullnose: Wainscot Cap. Color and finish to match adjacent wall surface.
   g. Base: Coved Base. Color and finish to match adjacent wall surface.
   h. Exterior Corners: Bullnose. Color and finish to match adjacent wall surface.
   i. Internal Corners: Field butted square corners, except with cove base and cap angle pieces designed to member with stretcher shapes. Color and finish to match adjacent wall surface.
   j. Window Sills at tile locations only: Provide Carrera Marble Window Sill.

2.3 ACCESSORIES
A. Thresholds: Solid surfacing material, color and finish to be selected, ½" inch thick by full width of wall or frame opening, beveled both sides, radiused edges from bevel to vertical face.
B. Floor Edging: Metal.
C. Backing Board:
1. High density, cementitious, glass fiber reinforced, ½" inch thick; 2" inch wide coated glass fiber tape for joints and corners, as recommended by manufacturer.
2. Moisture resistant gypsum board, 5/8" thick.
D. Sealant: Mildew resistant type, specified in Section 07900 - Joint Sealants.
E. Water: Potable

2.4 MORTAR MATERIALS
A. Organic Adhesive: ANSI A1 36.1, Type I, thinset bond type.

2.5 MORTAR BED
A. Mortar Bed: Portland cement mortar, full bed method.

2.6 GROUT TYPE
A. Grout: ANSI A1 18.6, Latex-Portland Cement Grout
1. Unsanded Dry Grout Mix: Dry set grout complying with ANSI A1 18.6, for grout joints 1/8" inch and narrower.
2. Latex Additive: Manufacturers standard.
3. Color: Selected by Owner

2.7 MORTAR MIX AND GROUT
A. Mix and proportion pre-mix mortar and grout materials in accordance with manufacturer's instructions.

PART 3 – EXECUTION

3.1 EXAMINATION
A. Verify that site conditions are ready to receive work.
B. Beginning of installation means acceptance of site conditions.

3.2 PREPARATION

A. Clean surfaces to receive ceramic tile of loose and foreign matter which could impair adhesion of tile backs to the surface.

B. Remove ridges and projections. Fill voids with patching compound compatible with setting materials.

C. Substrate Tolerances:

1. Maximum variation in substrate surface: 1/8” inch in 8’-0” feet.
2. Maximum height of abrupt irregularities: 1/32” inch.

3.3 INSTALLATION - WALLS

A. Install backing board over wood stud framing to manufacturer's instructions. Tape joints and corners, cover with skim coat of thinset mortar to a feather edge.

B. Install adhesive, tile, base and ceramic washroom accessories and grout to manufacturer's instructions.

C. Joint Widths:

1. Ceramic Wall Tile and Accessories: 1/16” inch
2. Place joints uniform in width.

D. Minimize pieces less than one half size. Locate cuts to be inconspicuous.

E. Fit tile around projections and at perimeter. Smooth and clean cut edges. Ensure that trim will completely cover cut edges.

F. Cut and fit tile tight to protrusions and perpendicular interruptions. Form corners and bases neatly.

G. Form internal angles square and external angles bullnosed

H. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

I. Sound tile after setting and before grouting. Replace any hollow sounding units.

J. Allow tile to set 48 hours minimum before beginning grouting.

3.4 ADJUSTING

A. Remove and replace tile units that have been damaged during installation.

3.5 PROTECTION and CLEANING

A. It shall the responsibility of the Contractor and/or subcontractor to replace any and all damaged tile units from the completion of installation until Substantial Completion.

B. Clean ceramic tile and threshold surfaces in accordance with TCA Maintenance Guide.

3.6 CERAMIC TILE SCHEDULE

A. Refer Drawings for tile designations and locations

END OF SECTION

SECTION 09 65 01

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient tile flooring.

1.2 SUBMITTALS

A. Submit under provisions of Section 013000:
   1. Samples: 2 full size tile samples showing available colors for each product.

1.3 PROJECT CONDITIONS

A. Maintain temperature in spaces to receive flooring between 70 and 90 degrees F for 24 hours before, during, and for minimum 48 hours after installation.
B. Maintain minimum temperature of 55 degrees F after flooring is installed, except as otherwise specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vinyl Flooring – 6 x 36 vinyl plank resilient flooring material
   1. Mohawk – Permanence - 2mm Thick – Color Selection by Owner
   2. Shaw – Expo 12 MIL – Color Selection by Owner
   3. Substitution as allowed per section 13000

2.2 ACCESSORIES

A. Leveling Compound: White, premixed, latex based.
B. Adhesive: Water based, waterproof, with mildew cide, recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of loose and foreign matter which could impair bond.
B. Fill cracks, voids, and depressions in substrate with leveling compound.
C. Grind off high spots and projections in substrate -I leave smooth and level to ¼ inch in .10 feet.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Apply adhesive uniformly over substrate, covering only that area which can be covered with flooring in recommended working time of adhesive" remove adhesive that has dried or filmed over.
C. Remove excess adhesive immediately.
D. Lay tile beginning in center of room or space; work towards perimeter. Lay square and symmetrical with room or space, with grain or pattern of each tile running as directed by Architect.
E. Align joints in adjacent tiles.
F. Lay to minimize tiles less than one-half size.

G. Fit flooring to perimeter walls and fixed objects with minimal space between flooring and abutments. Assure that base, trim, plates, or escutcheons will completely cover edges.
H. Extend flooring into recesses and under equipment.

3.3 CLEANING

A. Clean flooring in accordance with manufacturer's directions.

3.4 PROTECTION

A. Do not allow traffic on flooring until adhesives have set.
B. Cover areas subject to traffic with protective covering.

3.5 EXTRA STOCK

A. Furnish Owner, without additional cost, spare undamaged vinyl tile flooring of each type installed in amount of one-half (1/2) of one (1) percent of areas used or no less than one thousand (1,000) square feet of material. Spare or usable, left-over material, to be properly packaged and identified. Obtain receipt for extra stock from Owner's authorized representative.

END OF SECTION

SECTION 09 68 01

CARPET

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Carpet.
   2. Edgings and accessories.

1.2 SUBMITTALS

A. Submit in accord with section 01 300.
B. Submit complete color selections available. Samples to be exact samples of material proposed for use.
C. Submit three (3) shop drawings. Drawings to be retained by the Owner, showing layout of seams, all edge conditions, and conditions where joined or butted to adjacent materials.
D. Manufacturer's maintenance manual in three (3) copies.
E. Seam Layout: Contractor to submit his proposed seam layout per apartment type prior to the start of installation.
F. Submit written certification that all material provided is in compliance with HUD Use of Materials Bulletin 44D (UM 44d -93) copy attached.

1.3 QUALITY ASSURANCE

A. Carpet and all materials provided shall comply with HUD Use of Materials Bulletin 44D (UM 44d -93) copy attached.
B. The Subcontractor shall be an approved installer of the manufacturer and be experienced in carpet installation for at least five (5) years. The actual work shall be performed by qualified and experienced mechanics working under his supervision, who also have been performing this type work for five (5) years.
C. Notice is hereby made that strict adherence to this specification will be required by the Owner and that the Contractor shall certify that all materials supplied against this contract meet or exceed the standards established under "products" and are guaranteed free from manufacturing defects for five (5) years or term specified by manufacturer, whichever is greater.

1.4 HANDLING AND STORAGE

A. All carpeting shall be delivered to the job site in original mill wrappings with each roll having its register number properly attached, clearly marked as to size, dye lot, and materials.
B. Material shall be stored in an enclosed and dry area protected from damage and soiling coordinate location of storage area within building with general contractor.

1.5 PROJECT CONDITIONS

A. Do not begin installation until painting and finishing work have been completed.
B. Do not install if temperature of spaces or subfloor is below 50 degrees F.

1.6 GUARANTEES

A. Upon completion, the carpet contractor must submit a certificate guaranteeing the installation to be free of defects in workmanship for a period of one (1) year to include the statement that: The carpet contractor shall, at his own expense and upon written notice from the Architect, promptly correct/replace any and all improper work and material that may become apparent within twelve (12) months after the date of final completion. Contractor shall re-stretch underline carpet at the request of the Owner within this Guarantee period.

B. Carpet manufacturer must certify by register and roll numbers that carpet shipped for this project complies with all requirements of the specifications subject to normal manufacturing tolerances.
C. Manufacturer shall furnish to the Owner his standard warranty of not less than five (5) years.

1.7 MAINTENANCE MATERIALS (extra stock)

A. Furnish to the Owner an additional uncut two (2) percent of each quality, color, and pattern or carpet required for the work including clubhouse.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Units
   1. Units – **Carpet as selected by Owner/Interior Designer –**
      a. Refer to Interior Design Flooring Specifications for Unit Carpet
      b. Substitutions as allowed per section 13000.

B. Common areas
   1. Corridor area – **Refer to Interior Design Flooring Specifications for Corridor Carpet**
   2. Clubhouse and other Common Areas - **Carpet as selected by Owner/Interior Designer – Please refer to schedule of materials on Interior Design Documents**
      a. Pattern: To be selected by Interior Designer.
      b. Color: To be selected by Interior Designer
      c. Width: To be selected by Interior Designer

2.2 ACCESSORIES

A. Carpet Cushion: **7/16" Rebond Pad or (Carpet as selected by Owner/Interior Designer – Please refer to schedule of materials on Interior Design Documents)**
B. Adhesive: Waterproof, latex based cement formulated specifically for installing carpet; recommended by carpet manufacturer.
C. Edgings: Preformed metal, profile required to suit conditions, color to be selected.
D. Gripper Strip: As recommended by carpet manufacturer for carpet thickness, water resistant plywood with angular pins.
E. Leveling Compound: White, premixed, latex based.

PART 3 - EXECUTION

3.1 PREPARATION

A. Substrate:
   1. Remove loose and foreign matter.
   2. Fill cracks, voids, and depressions with leveling compound.
   3. Grind ridges and high spots smooth.

3.2 INSTALLATION

A. Carpet:
   1. Install carpet and cushion in accordance with manufacturer's directions.
   2. Install gripper strip at perimeter and around abutting objects. Secure to subfloor.
   3. Install cushion using maximum size pieces. Butt edges together and tight to gripper strip. Remove air pockets and wrinkles; tape joints with 2 inch wide waterproof tape. Secure to substrate by spot adhesive method.
   4. Stretch carpet according to manufacturer's instructions for percentage of stretch.
   5. Fasten carpet securely to strips so that all pins penetrate carpet backing. Tuck raw edges behind strips.
   6. Join seams with hot seaming tape. Form seams straight and free of peaks or gaps.

7. Follow Manufacturer's recommended seam procedure for Berber Carpet.
7. Fit carpet tight to abutting surfaces. Cut and fit around penetrations.
8. Provide monolithic color, pattern, and texture within each area.

B. Edgings:
1. Install strips where carpet abuts dissimilar flooring materials; secure to subfloor.
2. Center strips under doors where flooring terminates at door openings.
3. Install in longest practical lengths; butt ends tight.
4. Scribe to abutting surfaces.

3.3 CLEANING

A. Clean spots as recommended by carpet manufacturer.
B. Cut off loose threads flush with top surface.
C. Clean with commercial vacuum cleaner.
D. Protect materials in traffic areas.

3.4 EXCESS CARPET

A. All usable pieces of carpet not necessary to, complete the work are to be left on the job site and placed in an orderly manner in such area as designated by the Owner. Excess pieces of usable carpet, the least dimension of which is **six (6) feet,** shall be left with Owner for future repairs in addition to the two (2) percent required. (Two percent of the areas used).

END OF SECTION

SECTION 099100

PAINTING

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Taping, bedding, and texturing of gypsum drywall.
   2. Surface preparation and field application of paints to all interior and exterior surfaces and fixtures/accessories as indicated.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) C 475: Joint Treatment Materials for Gypsum Wallboard Construction.
B. Gypsum Association GA-214: Levels of Gypsum Board Finish.
C. Steel Structures Painting Council (SSPC): Steel Structures Painting Manual.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300:
   1. Product Data: Manufacturer's data on materials proposed for use. Include:
      a. Product designation and grade of each paint type.
      b. Surface preparation materials and procedures.
   2. Samples:
      a. 3 inch by 6 inch samples of each typo paint showing color and luster, on representative substrate. Apply each coat stopped back I inch so that all coats remain exposed. Indicate type of material used for each coat.
      b. 12 inch by 12 inch texture samples on gypsum board backing.
   3. Paint Schedule: Detailed schedule indicating typo and location of surface, paint materials, and number of coats to be applied.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver paints factory mixed.
B. Keep storage area dean; protect from paint spillage.

1.5 PROJECT CONDITIONS

A. Environmental Requirements:
   1 Apply paints under dry and dust free conditions.
   2. Ambient Temperature: As recommended by manufacturer.
   3. Humidity-. As recommended by manufacturer.
   4. Test surfaces to be painted with standard moisture meter" do not apply paint until moisture content is 14 percent or less.
   5. Perform work under adequate lighting conditions.

1.6 MAINTENANCE

A. Extra Stock: Provide Twenty (20) extra gallons of each type and color finish coat, in clean, marked containers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on products by Color Wheel Paints
B. Products for the Residential buildings by the following manufacturers are acceptable:
   1. Duron Paints
   2. Sherwin Williams
   2. Glidden Co.
   3. Pratt and Lambert.
D. Substitutions: Under provisions of Section 01600.

2.2 MATERIALS

A. Paints:
   1. Furnish all paints by the same manufacturer unless specified otherwise.
   2. Exterior primers:
      a. Ferrous metal primer: Color Wheel 330/1635 Primer
      b. Galvanized Metal Primer: Color Wheel 1635 Aquatec Acrylic Primer
      c. Wood primer: Color Wheel 330 Optima All Prime"
      d. Exterior Cementitious Siding Primer: Color Wheel 330 Optima All Prime
      e Exterior Stucco Primer: Color Wheel 335 Tropicoat Masonry Primer
      f Exterior Gypsum Surfaces Primer: Color Wheel 330 Optima All Prime"
   3. Exterior topcoats:
      a. Ferrous and Galvanized Metal Enamel paint: Color Wheel 760 Ironize Industrial Enamel
      b. Exterior Wood paint: Color Wheel 320 Tropicoat Semi Gloss House Paint
      c. Exterior Cementitious Siding: Color Wheel 300 Tropicoat Flat
      e. Exterior Stucco Surfaces: Color Wheel 300 Tropicoat Flat
      f. Exterior Gypsum Surfaces Primer: Color Wheel 300 Tropicoat Flat
   4. Interior primers:
      a. Ferrous metal primer: Color Wheel 330/1635 Primer
      b. Galvanized Metal Primer: Color Wheel 1635 Aquatec Acrylic Primer
      c. Drywall primer (Walls): Color Wheel Comex M004 Interior Property Maint Flat
      d. Wood primer: Color Wheel 430 Ti-Gard Interior Sealer
   5. Interior topcoats
      a. Metal Enamel Paint: Color Sheet C144 Ultra Tech Interior Acrylic Semi Gloss Enamel\
      b. Wood Enamel Paint Color Wheel Comex m033 Unit Ready Interior Property Maint Semi Glos
      c. Drywall Latex flat paint: "Color Wheel Comex M004 Interior Property Maint Flat
      d. Drywall Latex Satin: Color Wheel Comex M004 Interior Property Maint Satin

2.3 ACCESSORIES

A. Joint Treatment Materials:
   1. Reinforcing tape and joint compound: ASTM C 475.
   2. Texture: "Multi Purpose Texture Finish" by United States Gypsum Co. or accepted substitute.
B. Surface Preparation Materials: Formulated for particular application.
C. Thinners and Cleaners: As recommended by paint manufacturer.

2.4 MIXING

A. Colors: Owner will furnish color schedule prior to commencement of painting.
B. Use factory mixed paints matching accepted color samples.
C. Uniformly mix paints to thoroughly disperse pigments(its prior to applying.
D. Do not thin paint in excess of manufacturer's recommendations.

2.5 Exterior wood

A. Primer paint to Yield approximately 1.5 mils DFT. All trim to be boxed printed. Alkyd primers should be approximately 6OZ solids. The finish coat for siding and trim should be single coal of 100 % Acrylic Exterior or House Paint with a DFT of 2.5 mils. This provides a total system DFT of 4 mils. The acrylic exterior house paint should provide no less than 357 solids.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:
   1. Protect or remove items subject to damage or discoloration from painting.
   2. Protect surfaces not requiring painting.
   3. Clean and dry surface before painting. Remove dirt and dust by brushing with stiff bristle brush. Remove oil or grease by solvent cleaning.
   4. If area has been subject to chemical contamination, thoroughly rinse with water.
   5. Apply primer or first coat immediately after surface preparation to prevent contamination of surface.

B. Gypsum Board:
   1. Joint treatment: GA-214.
      a. Surfaces in storage closets: Level 2 finish.
      b. Water resistant gypsum board: Level 2 finish.
      c. Surfaces to receive flat paints: Level 4 finish.
      d. Surfaces to receive semigloss paints: Level 5 finish.
   2. Apply texture as selected by Owner in accordance manufacturer's instructions.

C. Wood and Hardboard Siding:
   1. Back prime wood installed against cementitious materials and all exterior wood and siding with one coat primer.
   2. Clean knots, pitch streaks, and sap spots of residue; treat with knot sealer prior to applying opaque finishes. Apply second coat of sealer minimum 2 hours after application of first coat
   3. Fill nail holes and other indentations with wood filler. Finish flush with adjacent surfaces.
   4. Sand surfaces smooth; remove dust prior to painting.

D. Non Primed Ferrous Metals: SSPC SP3 - Power tool cleaning.

E. Non Ferrous and Galvanized Metals: SSPC SP1 - Solvent cleaning method.

F. Primed Metals: Remove foreign matter and clean thoroughly. Clean and spot prime abraded areas with same primer as originally applied.

3.2 APPLICATION

A. Apply paint to minimum dry film thickness recommended by manufacturer.

B. Apply paint uniformly without laps, sags, curtains, holidays, and objectionable brush marks.

C. Allow each coat to cure completely before applying additional Goats.

D. Ensure that each coat is undamaged prior to applying succeeding coat.

E. Sand between coats on interior wood surfaces prior to application of succeeding coats.

F. Match final coat of paint to accepted color samples. Do not paint:

1. Surfaces indicated on Drawings or specified to be unpainted or unfinished.
2. Surf aces with factory applied finish coat or integral finish (Millwork and Doors with factory or shop prefinish).
3. Architectural metals, including brass, bronze, stainless steel, and chrome plating.

G. Mechanical and Electrical Items:
1. Paint factory primed equipment.
2. Remove unfinished and primed louvers, grilles, covers, and access panels; paint separately.
3. Prime and paint exposed and insulated pipes, conduit, boxes, ducts, hangers, brackets, collars, and supports unless factory finished.
4. Do not paint name tags or Identifying mouldings.
5. Paint interior surfaces of ducts and dampers that are visible through grilles and louvers with one coat flat black paint, to sight limit line.
6. Paint exposed conduit and electrical equipment in finished areas.

H. Roof Accessories/Stacks/Vents and all other roofing fixtures.
1. Paint factory primed equipment.
2. Remove unfinished and primed louvers, grilles, covers, and paint separately to match roof shingle color.
3. Prime and paint exposed and ducts, vents, stacks, insulated pipes, conduit, boxes, brackets, collars, and supports to match roof shingle color.

I. Gutters and downspouts to be painted to match adjacent building field color.

J.. Interior gypsum board paint finish to be one coat Hi-build / backrolled.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Ensure that materials are being applied properly.

3.4 ADJUSTING

A. Make detailed inspection of paint work; touch up abraded, stained, and otherwise disfigured surfaces or refinish as required.

3.5 CLEANING

A. Remove paint from adjacent surfaces.

3.6 PAINT SCHEDULE

A. Types of paint listed herein are set forth as standard of quality and type of paint required for each type of surface.
   1. Exposed surfaces of type listed in following schedule are to be painted.
   2. Other exposed surfaces not specifically listed shall receive not less than 2 coats of appropriate type of paint.

B. Prime coat shall consist of touch up only on shop primed surfaces.

SUBSTRATE	PRIMER	TOP COAT(S)
EXTERIOR SURFACES:		
Ferrous metals	Ferrous metal primer	2 coats enamel paint
Metal clad doors	Ferrous metal primer	2 coats enamel paint semigloss
Galvanized metals	None (Touch up if req'd.)	2 coats enamel paint
Wood	Wood primer	2 coats latex paint semigloss
Exterior Cementitious Siding	Factory Primed or Primer	2 coats acrylic latex paint
INTERIOR SURFACES:		
Gypsum board, flat finish	Gyp Primer	2 coats latex flat paint
Gypsum board, satin finish (ref: ID)	Gyp Primer	2 coats alkyd satin enamel paint
Ferrous metals	Ferrous metal primer	1 coat alkyd semigloss enamel paint
Galvanized metals	Galvanized metal primer	1 coat alkyd semigloss enamel paint
Wood	Wood primer	2 coats latex semigloss enamel paint

END OF SECTION 09900

SECTION 10 14 23

PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. All equipment and work specified in this section shall comply, with all the General Conditions of the specifications, contract documents, and drawings as indicated.

B. This Section includes the following:
1. Exterior signs on buildings
2. Interior signs
3. Accessible parking signage.
4. Fire lane signs.
5. Interior toilet room signs in Clubhouse.
6. Unit Identification.
7. Directional Signage.

1.2 REFERENCE STANDARDS

A. Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities.

B. ICC A117.1, Accessible and Usable Buildings and Facilities

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00

B. Samples: At the same time shop drawings are submitted, submit full-sized sample of each type of sign conforming to specification requirements as to letter size, spacing and style.

C. Shop Drawings and Manufacturers' Brochures: .

D. Template: Submit full-size template drawing for approval of letter size, stock, spacing, setting screws.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with specifications, provide products as manufactured by one of the following:
1. ASI Sign Systems, Grand Prairie, Texas.
2. Best Manufacturing Company, Kansas City, Missouri.
3. Mohawk Sign Systems, Schenectady, New York.
4. Nelson-Harkins, Chicago, Illinois.
5. Commercial Resources Group, Houston, Texas
6. Wood Concepts
7. Fource Communications.

B. Substitutions: Under provisions of the General Conditions.

2.2 PLASTIC SIGNS

A. General: Provide signs of type indicated in Signage Schedule.

B. Mechanically attach as recommended by sign manufacturer.

C. Plaque: **Melamine plastic laminate**, approximately 1/8 inch thick with contrasting core color, non static, fire-retardant and self-extinguishing, impervious to most acids, alkalis, alcohol, solvents, abrasives, and boiling water.

D. Graphic Process
   1. Raise tactile characters 1/32 inch from sign face by sandblasting process. Glue-on letters and etched backgrounds are not acceptable.
   2. Provide Grade 2 Braille for each text immediately below text.
   3. Perimeter borders:
   4. Finish: Non-glare for background and characters.

E. Characters:
   1. Letterform: Uppercase, sans serif typestyle, not italic, oblique, script, highly decorative, or other unusual forms.
   2. Depth: Raised a minimum of 1/32 inch above the background and without any sharp or abrasive edges.
   3. Proportion: Selected from fonts where the width of the uppercase letter “O” is between 55 and 110% of the height of the uppercase letter “I”.
   4. Stroke thickness: Thickness of the uppercase letter “I” is a maximum of 15% of the character height.
   5. Character Height: A minimum of 5/8 inch and a maximum of 2 inches based on the height of the uppercase letter “I”.

F. Braille: Grade 2 Braille, dots with domed or rounded shape, and without any sharp or abrasive edges.
   1. Depth: As tabulated in the ADA-ABA Accessibility Guidelines; generally raised about 1/32 inch above the background.
   2. Dot layout: As illustrated and tabulated in the ADA-ABA Accessibility Guidelines.
   3. Position on Sign: Below the corresponding text and separated a minimum of 3/8 inch from any other tactile characters, raised borders, and decorative elements.

A. Composition: Text as indicated on Signage Schedule

B. Place door signs on public side of door except where noted otherwise.

C. Properly finish edges of signs and with letters and numbers evenly and accurately cut.

D. Spacing of Letters and Numbers: Optically correct.

2.3 ACCESSIBLE PARKING SPACE SIGNS

A. Screen-printed, 18 gage bonderized steel with blue baked enamel finish and white screen-printed copy.
   1. Size: 12 inches by 18 inches and 12 inches by 6 inches.
   2. Copy:
      a. "Handicapped Parking Only".
      b. "Van Accessible".
      c. Accessible Passenger Loading Zones

B. Acceptable Products: Handicapped Parking: Best Traffic Signs No. SS04 with SS52 as required.

C. Post: Galvanized pipe column minimum 9 feet long.

2.4 FIRE LANE SIGNS

A. Screen-printed, 18 gage bonderized steel with white baked enamel finish and black and red screen-printed copy.

B. Size: 12 inches by 18 inches.

C. Copy: “Fire Lane" with no parking symbol.

D. Acceptable Product: Best Traffic Signs No. SS09.

E. Post: Galvanized pipe column. Length required to mount sign per local regulations.

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

A. Deliver and store identifying devices in protective wrappings until ready for installation.

3.2 INTERIOR INSTALLATION - ROOM SIGNS

A. Install signs plumb, level and square and in proper planes with other work so that all tactile characters are between 48” and 60” A.F.F.

B. Tactile Sign Location:
   1. Braille and raised character signs shall be located 4 inches from doorframe to meet ADA-ABA Accessibility Guidelines:
      a. On the wall adjacent to the latch side of a single-leaf door.
      b. On the inactive leaf of double doors with one active leaf.
      c. On the wall adjacent to the right-hand door of double doors with two active leaves.
      d. On the nearest adjacent wall if there is insufficient space for required wall-mounted signs.

B. Anchor each plastic sign with sufficient amount adhesive for proper installation as recommended by manufacturer for substrate.

3.3 EXTERIOR INSTALLATION - PARKING SIGNS

A. Install signs plumb, level, and square and in proper planes with other work, so that all tactile characters are between 48” and 60” A.F.F.

B. The International Symbol of Accessibility is required on signage for accessible building entrances and directional signs to accessible entrances.

C. Mount on wall surface as shown on plans.

D. Anchor each plastic sign with sufficient amount adhesive for proper installation as recommended by manufacturer for substrate

E. Mount posts in 12 inch round by 2'-6" deep concrete footing.

3.4 CLEANING

A. Remove protective materials and clean all signs. Clean surfaces with plain water or water with soap or household detergent.

3.5 SIGN SCHEDULE

A. Parking garage signage by others.

B. Refer to Civil drawings for site signage.

C. Entry Sign: **[Main entry Identification] [Main entry monument, double faced] [Building mounted signage – verify with Owner]**.

D. **[Clubhouse] [Leasing Center]** – Exterior:
1. Future resident stakes
2. Accessible Entrances
3. Information center.
4. Night deposit plaque.
5. Address Sign
6. Hour sign (summer/winter hours).
7. Mail Room Sign

E. **[Clubhouse] [Leasing Center]** – Interior:
1. Hour sign at corridor entrance.
2. Women's restroom (ADA)
3. Men's restroom (ADA)
4. Mechanical & Janitor Closets
5. Occupant Load / This door to remain unlocked during business hours
6. Employee only (Workroom and Restroom)
7. Mechanical Room
8. Riser Room
9. Maintenance Room
10. Mail Room ID
11. Parcel Storage Room
12. Manager
13. Assistant Manager
14. Conference Room
15. Fitness Center ID
16. Fitness Center policies
17. **Business Center ID**
18. Business Center policies
19. Clubroom ID
20. Clubroom policies
21. Clubroom Capacity – "Occupancy not to exceed **[##]** people"
22. Exit signs at interior side of all exits.

F. Fitness center – Interior:
1. Fitness center policies
2. Women's restroom (ADA)
3. Men's restroom (ADA)
4. Lounge
5. Occupant Load / This door to remain unlocked during business hours

G. Mail Room ID

H. Bathhouse:
   1. Women's restroom (ADA) – corridor and exterior entrances
   2. Men's restroom (ADA) – corridor and exterior entrances

I. Traffic Signage:
   1. Stop signs.
   2. Handicapped parking signs.
   3. Reserved parking spaces signage.
   4. Vehicle gate access instructions

J. Building Signage:
   1. Building Entrance Signs
   2. Accessible Entrances
   3. Directional to Accessible Entrances
   4. No Smoking in public areas or within 25' of entries or windows.
   5. Building Number Signs
   6. Unit door numbers.
   7. Storage Room
   8. Telecommunication Room
   9. Electrical and Mechanical Room ID ("No Storage")
   10. Fire Sprinkler Signs
   11. Fire Riser Room
   12. FDC (verify location with Fire Department)
   13. Meter Room
   14. Not Accessible Means of Egress Identification at non-accessible elevator
   15. Emergency Response route to pool including International symbol for emergency medical service (star of life)at garage entry, first level elevator lobby, accessible elevator, inside elevator indicating level, third level corridor, bathhouse corridor entrance, pool entrance from bathhouse.

K. Pool Area Signage:
   1. Occupant Load / This door to remain unlocked during operable hours
   2. Hours of Operation
   3. Warning: "No Lifeguard on Duty"
   4. 911 phone
   5. CPR instructional panel.
   6. Room designated for emergency care of casualties
   7. Water test results
   8. Authorized Personnel Only at filter and chemical storage room doors.
   9. Pool rules and regulations regarding personal health and safety at each entrance:
      a. If you have or have had diarrhea in the past two weeks, please do not use the pool.
      b. Shower your child and yourself before entering the pool or after using the toilet.
      c. Bathers who are not toilet trained or incontinent persons must wear a swim diaper.
      d. Do not drink pool water.
   10. Maximum facility load and swimming pool load at the main entrance (letters and numbers minimum of 2" height)
   11. No diving (letters minimum of 5" height).

END OF SECTION

SECTION 102800

TOILET ACCESSORIES

PART 1- GENERAL

1.1 SUMMARY
A. Section includes:
   1. Toilet and shower accessories.
   2. Attachment hardware.

1.2 REFERENCES
A. American Society for Testing and Materials (ASTM):
   1. A 123: Zinc (Hot Dip Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.
   2. A 269: Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   3. B 456: Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
   4. C 1036: Flat Glass.

1.3 SUBMITTALS
A. Submit under provisions of Section 01300:
   1. Product Data: Manufacturer's brochures showing sizes, details of function, finishes, and attachment methods.
   2. Samples: One of each accessory.

1.4 WARRANTY
A. Mirrors:
   1. Warranty period: 5 years.
   2. Warrant against silver spoilage resulting from manufacturing defects.

1.5 MAINTENANCE
A. Label keys and forward directly to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Acceptable Manufacturers:
   1. Pamex Bath Accessories – Corona Collection
   2. Bobrick
   3. Cweco
   4. Taymor
B. Substitutions: Under provisions of Section 01600.

2.2 MATERIALS
A. Galvanized Steel: ASTM A 366.
B. Mirror Glass: ASTM C 1036, Type 1, Class 1, Quality.

2.3 ACCESSORIES
A. Fasteners: Chrome plated steel all concealed, hot dip galvanized; type best suited to substrate conditions.

2.4 FABRICATION

A. Use chrome plated steel for exposed surfaces; galvanized steel may be used in concealed locations.
B. Form exposed surfaces from single sheet of stock, free from joints, and flat, without distortion.
C. Provide hangers, adapters, anchor plates, and accessories required for installation.
D. Framed Mirrors:
   1. 3/16 inch thick clear with ¾" x 2" Chrome Frame on all sides. .
   2. Apply 1 coat of silver and 1 coat of electroplated copper to back surface of glass.
E. Shop assemble units and package complete with anchors and fittings.
F. Finishes:
   1. Galvanizing: ASTM A 123 to 1.25 ounces per square foot.
   2. Chrome plating: ASTM B 456, Type SC 2, polished finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Set plumb, level, square, and rigidly anchored.
C. Conform to applicable code for locating accessories for handicapped access.

3.2 SCHEDULE

Schedule – Apartment Units:

Grab Bars (provide only in units designed for the handicapped):
Material: 1 ¼ diameter stainless steel, satin finish.
Construction: 1 ½ inch clearance between grab bar and wall.
Mounting: Surface mounted, exposed screw application.
Acceptable products: Pamex Concealed SS Grab Bar Model 12XXC Series, lengths as detailed.

Toilet Tissue Dispenser:
Material: Polished chrome.
Mounting: Surface mounted, exposed screw application
Capacity: One roll.
Acceptable product: Pamex Corona Series Model BC3-41.

Towel Bar: Provide one (1) 24" long towel (Or 18"- refer to unit layouts) bar at each lavatory, u.n.o, refer to drawings for locations.
Material: Polished chrome.
Mounting: Surface mounted, concealed fasteners.
Acceptable product: Pamex Corona series, Model BC3-13824 - 24" (or 18")

Medicine Cabinet. Semi-Recessed, plastic cabinet with mirrored faced door, reversible for each bathroom, as selected by Owner. One (1) at each bathroom. Creative Images Classic Reflections 1418/1424

Shower Rod: Provide one (1) for each tub/shower
Material: 20 gage, 1 inch diameter, polished chrome tubing.
Mounting: 1 inch diameter flange.
Acceptable product: Pamex BSRCP-511 or as approved by Owner.

Robe Hook: Provide one robe hook on the back of each bathroom door. (and other location adjacent to Tub/Shower as indicated on unit layout drawings)

Ceramic soap dish: Provide one (1) soap dish unit for each tub/shower.
Material: to match and be compatible with ceramic tile selected.

Ceramic tile bar: Provide one (1) 24" long ceramic tile bar unit for each tub/shower.
Material: to match and be compatible with ceramic tile selected.

Mirror: Provide one (1) mirror with 2" x ¾" Frame at all Lavatory/Vanity Locations. Size as indicated on Drawings
Material: 3/16 Mirror Glass, Chrome Frame

Schedule – Clubhouse:

Grab Bars (provide only in units designed for the handicapped):

Material: 1 ¼ diameter stainless steel, satin finish.
Construction: 1 ½ inch clearance between grab bar and wall.
Mounting: Surface mounted, exposed screw application.
Acceptable products: Pamex Concealed SS Grab Bar Model 12XXC Series, lengths as detailed.

Paper Tower/Waste Dispenser

Semi Recessed - Bobrick, B369

Toilet Paper Dispenser:

Double Roll Dispenser – Bobrick B2740

Liquid Soap Dispenser

Bobrick B-155

3.3 CLEANING

A. Clean all surfaces of bath accessories with damp cloth.

END OF SECTION

SECTION 104400

FIRE EXTINGUISHERS

PART 1- GENERAL

1.1 REFERENCES

A. Underwriters Laboratories (UL):
   1. 299: Dry Chemical Fire Extinguishers.
   2. 71 1: Rating and Fire Testing of Fire Extinguishers.

1.2 SUBMITTALS

A. Maintenance Data:
   1. Submit under provisions of Section 01700.
   2. Include test, refill, or recharge schedules and re-certification requirements.

1.3 QUALITY ASSURANCE

A. Provide fire extinguishers complying with UL 71 1.
B. Regulatory Requirements: Conform to applicable code for quantity and location of fire extinguishers.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Extinguishers: Multi-purpose dry chemical type: UL 299, cast steel tank, Class and nominal capacity as required by Code. 2A:10 B,C minimum size
   Provide one 2 ½ lb. extinguisher in every unit – Mount on Hanger in cabinet under kitchen sink.
   Provide additional 10 lb. extinguishers in Type I and II Buildings as noted on construction documents
   Provide Three 10 lb. extinguishers in Clubhouse, Three 10 lb. in Fitness Building and Three 10 lb, in Parcel Building, and One in Maintenance Garage. – Provide in semi recessed mount cabinet. (Handicapped Access compliant)

B. Cabinets:
   1. Formed sheet steel, 18 gauge.
   2. Configuration: Semi Recessed mounted, sized to accommodate extinguishers.
   3. Door.- Break glass style, equipped with lock.
   4. Glazing: Clear tempered.

C. Finishes:
   1. Cabinets: Baked enamel, white color.
   2. Extinguishers: Baked enamel, red color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets in accordance with manufacturer's directions.
B. Locate to provide for handicapped access.
C. Secure rigidly in place using fasteners best suited to substrate.
D. Place one extinguisher in each cabinet.
E. Location as specified by Local Jurisdiction.

END OF SECTION

SECTION 105520

POSTAL SPECIALTIES

PART 1 GENERAL

A. Submittals: Manufacturer's data and installation instructions, finish samples, and shop drawings showing locations, elevations, and sections.

B. Requirements of Regulatory Agencies: Comply with current requirements for materials, products, and installation in applicable U.S. Postal Service (USPS) Publications.

PART 2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following, but not limited to:

1. Auth-Florence Manufacturing Cc., 2101 N. Elston Avenue, Chicago, IL 60614 Tel: 1-800-275-1747, Fax: 773-384-3460.
2. Salsbury Corporation 1010 East 62nd Street Los Angeles, CA 90001
3. Bommer Industries, Inc. 19810 Asheville Highway, Landrum, SC, 29356

B. Wall Mount – Recessed Horizontal Front Load Mail Boxes: Provide one USPS Specification 4C mailbox per apartment unit minimum. Provide USPS 4C Suite F box configurations in the arrangement shown in the drawings. Size and Parcel ratio in accordance with USPS Specification 4C Box Configuration. Manufacturer's standard, heavy-gauge aluminum construction with each compartment equipped to receive tenant's name card.

1. Front-Loading Type: Manufacturer's standard unit, with solid closure and positive latching mechanism.
2. Locking: Construct unit with provisions to receive locks provided by local postmaster for access by letter carriers for loading.
3. Compartment Doors: Extruded aluminum with satin-anodized finish to suit type of frame and loading method, and as shown on drawings.
    a. Door Locks: USPS approved five-pin cylinder with two keys for each door. Key each lock differently and master key.
    b. Identification: Heat-stamped numbers on plastic tabs or engraved numbers on door face, as indicated.
    c. Mailboxes to be grouped in combinations of 5 compartments high with width as indicated on the Drawings.
    d. All horizontal mailboxes shall be recessed mounted.

C. Parcel Lockers: Provide recessed wall mounted, front loading parcel lockers units integrated in combination with horizontal mailboxes as shown, of size and type indicated. Comply with USPS Publication.

1. Compartment: Manufacturer's standard design fabricated of aluminum with finish matching compartment door finish.
2. Front Doors: One-piece aluminum plate or extrusion with Bronze anodized finish.

3. Identification: Match locker and key numbers as shown or, if not shown, as designated by USPS from manufacturer's standards.

4. Locking: Dual-lock mechanism on each door that retains the tenant key until released by the USPS control key. Door lock is a five-pin cam lock, and the key retainer lock is either an Arrow postal service lock or other USPS-approved lock.
5. Front Door or Cover: Design and construct to swing or slide open or be removed to permit parcel loading. Secure door in closed position by latch or other closing mechanism on outside of door and design to prevent opening from front of locker.

D. Horizontal Collection Box:
1. Front loading box prepared for postal master lock.
2. Extruded aluminum front door 5/32" thick and extruded aluminum frame assembly. Bronze Anodized aluminum finish to match mailboxes.
3. Provide 3/4" x 10" wide letter slot.
4. Provide steel collection compartment.
5. Recess collection box as indicated on the Drawings.

E. Rental Drop Box:
1. Provide One Rent Drop Box in the Leasing Office as indicated on the Drawings.

PART 3 - EXECUTION

A. Installation: Comply with applicable USPS Publications and manufacturers instructions. Install complete with grounds, brackets, anchors, trim, and accessories.

END OF SECTION

SECTION 105700

WIRE SHELVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. General provisions of Contract, including General and Supplementary Conditions and Division 1 – General Requirements, apply to work specified in this section.

1.02 DESCRIPTION OF WORK

A. Extent of this work shall be as indicated on drawings and/or specified herein.

1.03 SUBMITTALS

A. Manufacturer's literature complete with installation procedures.

PART 2 - PRODUCTS

2.01 MANUFACTURER, MATERIALS

A. Provide ventilated vinyl coated steel shelving system.

B. Provide the following type shelving in the following areas, except as noted on Drawings.

1. Laundry: One (1) 6" shelf continuous above laundry equipment "L-16"/storage closet – one shelf.
2. Other Locations as indicated on the construction drawings. .

PART 3 - EXECUTION

3.01 INSTALLATION

A. Painting, finishing of surfaces to receive shelving systems shall be completed before commencing any installation of shelving. Install plastic caps at all exposed ends.

B. Complete installation shall be as per manufacturer's standard printed specification recommendation.

END OF SECTION

SECTION 10 73 13.13

ALUMINUM AWNINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fabrication and installation of extruded aluminum overhead awnings.

1.2 SUBMITTALS

A. Submit engineered shop drawings showing structural component locations/positions, material dimensions, and details of construction and assembly.
   1. Submit engineering calculations showing wind load requirements of local building department and include fastener and erection details, signed and sealed by qualified professional engineer responsible for their preparation.

B. Submit manufacturer's literature and specifications.

1.3 FIELD MEASUREMENT

A. Confirm site dimensions prior to manufacturing. Show recorded measurements on shop drawings.

1.4 QUALITY ASSURANCE

A. Welding Standards: Comply with applicable provisions of following.
   1. AWS D1.2, Structural Welding Code – Aluminum.

B. Welder Qualifications: Submit certification that each welder has satisfactorily passed AWS qualification tests for types of welding processes involved on project and has performed similar welds during the preceding 6 months.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store awning components in protected areas.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Architectural Fabrication, Inc.
   2. Awning Works Inc.
   3. Inpro Fabrication.
   4. Victory Awning.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage qualified professional engineer, as defined in Division 01 “Quality Requirements” Section, to design units, including attachment to building construction.

B. Awning shall conform to local building codes.

2.3 MATERIALS

A. Perimeter Framing (Facia), Bracing, and Diagonal Support Arms: Minimum extruded aluminum, alloy 6063-T5, in profile and thickness as determined by engineering requirements.

B. Inset Paneling: Style, material, and thicknesses as specified on Drawings.

C. Attachment Hardware: Rust resistant or stainless steel.

2.4 FINISHES

A. Powder-Coat Finish: AAMA 2603 except with minimum dry film thickness of 1.5 mils.
   1. Color and Gloss: As selected by Architect from manufacturer’s full range.

2.5 FABRICATION

A. Fabricate to sizes, configurations and shapes as detailed. Provide exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness, except where these features are a design feature of the ornamental item.
   1. Provide anchorage devices as indicated on Drawings and as required for complete installation.

B. Framework connections shall be MIG or TIG welded. Mechanical connections shall be used for panel integration and support members. Locknuts shall be used exclusively.

C. Fabricate panels as interlocking aluminum members, except for sheet designs and louvers with mechanical fasteners shop applied whenever possible to provide structural integrity for completed assembly. Field assemble completed sections .

D. Fabricate units to drain water from covered surfaces to front edge of awning.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Confirm that surrounding area is ready for awning installation.

B. Confirm dimensions and elevations are as shown on drawings provided by manufacturer.

C. Erection shall be performed by approved installer and scheduled after painting, masonry and roofing in the area is completed.

D. Install in accordance with manufacturer’s shop drawings. Protect finish during handling and erection. Apply field touch-up paint to marred areas.

E. After installation, leave work site and awning in clean condition.

END OF SECTION

SECTION 122011

HORIZONTAL LOUVER BLINDS

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Horizontal slat louver blinds at windows
   2. Operating hardware.

1.2 SUBMITTALS

A. Submit under provisions of Section 01300:

1.3 PROJECT CONDITIONS

A. Verify actual dimensions at site prior to fabrication of blinds.
B. Do not install blinds until painting and finishing work is complete.

1.4 EXTRA STOCK

A. Provide 2 extras of each size installed to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Hunter Douglass, Levelor, Kirsch Corporation.
B. Substitutions: Under provisions of Section 01600.

2.2 FABRICATION

A. Louver Slats: 2 inch wide, prefinished Faux Wood PVC horizontal slats with radiused corners.
B. Slat Support: Woven polypropylene ladders.
C. Head Rail: Prefinished, formed aluminum or steel box, internally fitted for hardware, pulleys, and bearings for blind operation.
D. Cord: Braided nylon or polypropylene, continuous loop.
E. Control Wand: Clear, hollow extruded plastic, non-removable, height of window-opening less 12 inches-
F. Support Brackets: Suitable for wall or soffit Mounting, formed metal to match head rail, allowing removal of head rail for maintenance without removing bracket.
G. Operation: Provide full range lift locking.
H. Finishes
   1. Slats, and head rails, and brackets: color to be selected.
   2. Ladders and cords: Dyed to closely match slats.
I. All materials to be lead free.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Use intermediate support brackets if necessary to prevent head rail deflection.
C. Maintain ¼ to ½ inch side clearance between slats and perimeter construction.

3.2 ADJUSTING

A. Test and adjust blinds for proper operation.

END OF SECTION

SECTION 122012

VERTICAL LOUVER BLINDS

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 vertical louver vane blinds.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 6 Section "Miscellaneous Carpentry" for wood blocking and grounds for mounting vertical louver blinds.
   2. Division 8 Sections for window walls with vertical louver blinds mounted on window frames.
   3. Division 8 Sections for windows with vertical louver blinds mounted on window 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 vertical louver blind specified. Include printed data on physical characteristics.

C. Shop drawings showing location and extent of blinds. Show installation details at and relationship to adjoining work. Include elevations indicating blind units. Indicate location of blind controls.

D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors, textures, and patterns available for each type of vertical louver blind indicated.

E. Samples for verification of the following items, 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.
   1. Louver: Manufacturer's standard-size unit, not less than 12 inches (300 mm) long.
   2. Louver Material: 12-inch- (300-mm-) square unit, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
   3. Valance: Manufacturer's standard-size unit, not less than 12 inches (300 mm) long.

F. Schedule of vertical louver blinds using same room designations indicated on Drawings.

G. Maintenance data for vertical louver blinds to include in the operation and maintenance manual specified in Division 1. Include the following:
   1. Methods for maintaining vertical louver blinds and finishes.
   2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide vertical louver blinds identical to those tested for the following fire-test-response characteristics as determined by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Test Method: NFPA 701.
   2. Rating: Pass.

B. Electrical Component Standard: Provide components that comply with NFPA 70 "National Electrical Code" and that are listed and labeled by UL.

C. Single-Source Responsibility: Obtain each type of vertical louver blind from one source and by a single manufacturer.

D. Mockups: Before installing vertical louver blinds, construct mockups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's acceptance of mockups before start of final unit of Work.
   5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a. When directed, demolish and remove mockups from Project site.
      b. Accepted mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual vertical louver blind dimensions 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.

B. Space Enclosure and Environmental Limitations: Do not install vertical louver blinds 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.

1.6 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. Vertical Louver Blinds: Before installation begins, furnish quantity of full-size units equal to 5 percent of amount of each size installed.
   2. Vertical Louver Vanes: Before installation begins, furnish quantity of full-size units equal to *5* percent of amount of each size installed.

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:

B. Manufacturers: Contract based upon Prism Window Products. Equivalents by one of the following:
   1. Vertical Louver Blinds:
      a. Faber.
      b. Hunter Douglas, Inc.
      c. Joanna Western Mills Co.
      d. Kirsch.
      e. Levolor Corp.
      f. Louverdrape, Inc.
      g. Nanik.
      h. Springs Window Fashions Division, Inc.; (Bali-Graber).
      i. Verosol USA, Inc.

C. Available Products: Subject to compliance with requirements, vertical louver blinds that may be incorporated in the Work include, but are not limited to, the products specified in each Product Data sheet at the end of this Section.

D. Products: Subject to compliance with requirements, provide one of the products specified in each Product Data sheet at the end of this Section.

2.2 VERTICAL LOUVER BLINDS

A. Louvers: Manufacturer's standard as follows:
   1. 2" wood grain PVC.
   2. Nominal Louver Width: 2 inches (50 mm).
   3. Lover Profile: Curved.

B. Controls: As follows:
   1. Louver Directional Control: Chain.
   2. Traversing Control: Manual with cord.
      a. Draw: One way, left.
      b. Draw: One way, right.

C. Louver Bottom: Weights.

D. Valance: Match color of louvers.

E. Mounting: Wall.

F. Colors and Patterns: Where manufacturer's standard products are indicated, provide vertical louvers complying with the following requirements:
   1. Match colors and patterns indicated by referencing manufacturer's standard designations for these characteristics.
   2. Provide Architect's selections from manufacturer's full range of colors and patterns for vertical louver blinds of type indicated.

2.3 FABRICATION

A. Louver Directional and Traversing Control Mechanisms: Noncorrosive, self-lubricating materials.

B. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Blind Units Installed Outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Louver Spacing: Overlapped for light exclusion when fully closed.

D. Installation Fasteners: Not less than 2 fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; support blind units under conditions of normal use.

PART 3- EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of vertical louver blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install blinds level and plumb. Do not remove warning labels describing hazards of vertical louver blinds.

3.3 ADJUSTING

A. Adjust components and accessories for proper operation.

3.4 CLEANING

A. Clean blind surfaces, according to manufacturer's instructions, after installation.

B. Remove surplus materials, packaging, rubbish, and debris resulting from installation. Leave installation areas neat, clean, and ready for use.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensure that vertical louver blinds are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 123530

RESIDENTIAL CASEWORK

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Prefabricated modular wood cabinets.
   2. Tops and splashes.

1.2 REFERENCES

A. ANSI A161.1: Minimum Construction and Performance Standards for Kitchen and Vanity Cabinets.
B. BHMA Al 56.9: Cabinet Hardware.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300:
   1. Shop Drawings: Include casework locations, large scale plans, elevations, rough-in locations, dimensions, tolerances, and clearances required.
   2. Product Data: Manufacturer's data showing construction details, configurations, materials, hardware, and accessories. Labeling indicating compliance with ANSI A161.1.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ANSI A161.1.
B. Fabricator Qualifications: Minimum 3 years experience in work of this Section.

1.5 EXTRA STOCK

A. Provide one of each cabinet type to owner and two additional of each door and drawer size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on L'arte Della Cucinna (Cabinet Design by Owner)
B. Alternate Master Wood Craft (50% shaker products by the following manufacturers are acceptable:
C. Substitutions: Under provisions of Section 01600.

2.2 COMPONENTS

A. Cabinet Construction:
   1. 42" tall upper cabinets
   2. Front frames: Wood Veneer
   3. End panels: Wood Veneer over 1/2 inch particleboard.
   4. Back: Thermal fused melamine over 1/8 inch hardboard.
   5. Doors and drawer fronts: Design as Selected by Owner – Prefinished Wood Veneer
   6. Buttons: Thermal fused melamine over 3/8 inch particleboard.
   7. Shelves: Thermal fused melamine over 1/2 inch particleboard, edge banded.
   8. Toe kicks: Thermal fused melamine over ½ inch particleboard.

9. Kitchen Countertops: 3 cm Granite Base Bid (with pricing for Lvl 1, Lvl 2, and Lvl 3 Granite Selections) with 4" Granite backsplash (4x10 Ceramic Tile Alternate Bid in lieu of 4" Granite). (3cm Quartz ALTERNATE BID).
10. Bathroom Countertops: 2cm Quartz with 4" Quartz Back and Side Splash.

B. Accessories:
1. Fasteners: Size and type to suit application.
2. Concealed joint fasteners: Threaded steel.
3. Finish hardware:
a. ANSI A156.9, manufacturer's standard.
b. Door hinges: To be selected by Owner.
c. Door and Drawer Pulls (brushed nickel finish to be selected by Owner from Mfr Standard)

2.3 FABRICATION

A. Shop assemble casework in units of sizes and configurations indicated.
B. Fabricate corners and joints without gaps and inaccessible spaces.
C. Fabricate each unit to be rigid, not dependent on adjacent units for stability.
D. Form edges smooth.
E. Use as large as possible granite pieces on Kitchen Counters – provide additional length for field trimming to exact location.
F. Provide cutouts for fixtures and appliances.
G. When necessary to allow for field fitting, provide materials with ample allowance for cutting. Provide trim required by site conditions.
H. Finishes:
1. One kitchen cabinet to have glass panel
2. (Final Selection by Owner/Interior Designer)
3. Granite or Quartz 3cm: To be selected by Owner/Interior Designer
a. Granite or Quartz Countertops to be 3 cm with eased edges and polished sink edges to accept under counter mount sink. .
4. Bathroom vanities to be same style and finish as kitchen cabinets.
a. Quartz Countertops to be 2 cm with eased edges and polished sink edges to accept under counter mounted sink - standard colors 4" with backsplashes.
5. Granite or Quartz Countertops: Color and pattern to be selected by owner

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install casework in accordance with manufacturer's instructions.
B. Use anchoring devices suited to site conditions.
C. Set level, plumb, and square, securely anchored to adjacent construction.
D. Scribe casework abutting other component, with maximum 1/32 inch gaps. Use filler strips to conceal larger voids, do not overlay materials.
E. Close ends of units-bases, shelves, and splashes.

3.2 ADJUSTING

A. Adjust doors and drawers to operate smoothly.
B. Touch up minor scratches and abrasions to match original finish.

END OF SECTION

SECTION 12 36 40

NATURAL STONE COUNTERTOPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior Granite
      a. Vanity Tops
      b. Countertops
      c. Backsplashes

1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
   1. Product data for each type of stone and other manufactured products required.
   2. Shop Drawings detailing fabrication and installation of stone. Include cutting and setting Drawings indicating sizes, dimensions, sections, and profiles of stones, arrangement and provisions for jointing, supporting, anchoring, and bonding stonework, and details showing relationship with, attachment to, and reception of related work.
      a. Include large-scale details of decorative surfaces and inscriptions.
      b. Colored pointing mortar and grout samples for each color required showing full range of exposed color and texture to be expected in completed work.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility for Stone: Obtain each color, grade, finish, type, and variety of stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to cut and finish material without delaying the progress of the work.

B. Installer Qualifications; Engage an experienced installer who has completed stone cladding similar in material, design, and extent to that indicated for project that has resulted in construction with a record of successful in-service performance.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in undamaged condition.

B. Store and handle stone and related materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breakage, chipping, or other causes.
   1. Do not use pinch or wrecking bars.
   2. Lift with wide-belt-type slings where possible. Do not use wire rope or ropes containing tar or other substances that might cause staining. If required to move stone, use wood rollers with cushions at end of wood slides.
   3. Store stone on wood skids or pallets covered with nonstaining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones.
   4. Protect stored stone from weather with waterproof, nonstaining covers or enclosures, but allow air to circulate around stones.
   5. Store cementitious materials off the ground, under cover, and in dry location.

1.5 PROJECT CONDITIONS

A. Do not set stone when air temperature or material temperature is below 50 degrees F. (10 degrees.

B. Maintain minimum ambient temperatures of 50 degrees F. (10 degrees C.) during installation and for seven days after completion, unless higher temperatures are required by fabricator's or supplier's instructions.

C. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Comply with referenced standards and other requirements indicated applicable to each type of material required.

2.2 GRANITE

A. MANUFACTURERS
   1. Stone Materials: HMF, Inc
   2. China Granite.

B. Materials, Finish and Color: Selected by owner.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, natural color, white, or a blend to produce mortar color indicated.
   1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement - Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
   1. For pigmented mortars, use colored portland cement-lime mix of formulation required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed ten percent of portland cement by weight for mineral oxides nor two percent for carbon black.

D. Aggregate: ASTM C 144

E. Water: Potable

2.4 ADHESIVES, SEALANTS AND SEALERS

A. General: Use only adhesives formulated for stone and ceramic tile and recommended by their manufacturer for the application indicated.

B. Water-cleanable Epoxy Adhesive: ANSI A118.3

C. Sealant for Countertops: Clear silicone sealant complying with requirements of Division 7 Section - "Joint Sealants and Caulking".

D. Penetrating Sealer: Penetrating sealer that protects the exposed faces of stone and grout from staining. Sealer shall be UV transparent; non-yellowing; VOC compliant; mold and mildew resistant; and USDA approved as safe on food handling surfaces. Material shall exceed ADA standards for slip resistance at traffic areas.

2.5 GROUT

A. Grout Colors: Provide colors to comply with the following requirements:
   1. Refer to Interior Finish Index.

2.6 DIMENSION STONE FABRICATION

A. General: Fabricate dimension stonework in sizes and shapes required to comply with requirements indicated, including details on Drawings and final Shop Drawings.
   1. For granite, comply with recommendations of National Building Granite Quarries Association's (NBGQA) "Specifications for Architectural Granite".

B. Cut and drill sinkages and holes in stones for anchors, fasteners, supports, and lifting devices as indicated or needed to set dimension stonework securely in place. Set beds to fit supports.

C. Cut stones to produce pieces of thickness, size, and shape indicated to comply with fabrication and construction tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.
   1. Clean sawn backs of stones to remove rust stains and free iron particles.

D. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.

E. Fabricate molded work, including washes and drips, to produce stone shapes having a uniform profile throughout their entire length and with precisely formed arises slightly eased to prevent snipping, and matched at joints between units.

F. Carve and cut decorative surfaces and inscriptions to conform with Drawings. Use skilled stone carvers experienced in the successful performance of work similar to that indicated.

G. Finish exposed faces and edges of stones to comply with requirements indicated for finish under each type and application of stone required and to match approved samples and field-constructed mock-ups.

H. Carefully inspect finished stones at fabrication plant for compliance with requirements relative to qualities of appearance, material, and fabrication. Replace defective stones with ones that do comply.
   1. Grade and mark stones for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stones match range of colors and other appearance characteristics represented in approved samples and field-constructed mock-ups.

2.7 STONE COUNTERTOP FABRICATION

A. General: Fabricate stone countertops in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.

B. Thickness: Provide thickness indicated, but not less than the following:

1. Nominal Thickness: 11/16 inch (2cm) bathrooms, 3cm at kitchens and clubhouse.
2. Edge Detail: Bullnose.
3. Backsplashes: 4 inches, same material as countertop at units, ceramic tile at clubhouse.

2.8 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' instructions relative to mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality and with optimum performance characteristics.
   1. Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or calcium chloride, unless otherwise indicated.
   2. Mixing: Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortars and grout when they have reached their initial set.

B. Portland Cement/Lime Setting Mortar for Nonpaving Installations: Comply with ASTM C 270, Proportion Specification, for types of mortars and stone indicated below:
   1. Set stone with Type S mortar.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive dimension stonework, and conditions under which dimension stonework will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of dimension stonework. Do not proceed with installation until unsatisfactory conditions have been corrected.
   1. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of dimension stonework.

3.2 PREPARATION

A. Advise installers of other work about specific requirements relating to placement of inserts, flashing reglets, and similar items to be used by stonework installer for anchoring, supporting, and flashing of dimension stonework. Furnish installers of other work with Drawings or templates showing locations of these items.

B. Protect dimension stonework during installation as follows:
   1. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials from stone without damage to latter.

C. Clean stone surfaces that have become dirty or stained prior to setting to remove soil, stains, and foreign materials. Clean stones by thoroughly scrubbing stones with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh filler or abrasives.

3.3 SETTING DIMENSION STONE, GENERAL

A. Execute dimension stonework by skilled mechanics, and employ skilled stone fitters at the site to do necessary field cutting as stones are set.
   1. Use power saws to cut stones. For exposed edges, produce edges that are cut straight and true.

B. Set stones to comply with requirements indicated on Drawings and final Shop Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure dimension stonework in place. Shim and adjust anchors, supports, and accessories to set stones accurately in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.

3.4 INSTALLING COUNTERTOPS

A. General: Install countertops over plywood subtops with a full spread of water-cleanable epoxy adhesive.

B. Bond seams with stone seam adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to seams to prevent adhesive smears. Use clamps to ensure countertop units are properly aligned and seams are minimum width.

C. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts while cutting to prevent damage.

3.5 ADJUSTING AND CLEANING

A. Remove and replace or repair stonework of the following description:

1. Broken, chipped, stained, or otherwise damaged stones. Broken, chipped, stained, or otherwise damaged stone may be repaired, providing the methods and results are acceptable to Owner's Representative.
2. Defective joints.
3. Stones and joints not matching approved samples.
4. Stonework not complying with other requirements indicated.

B. Replace in manner that results in stonework matching approved samples and field-constructed mock-ups, complying with other requirements, and showing no evidence of replacement.

C. Clean stonework not less than six days after completion of work, using clean water and stiff bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.

3.6 SEALER APPLICATION

A. All surfaces must be clean and free from all loose grit and debris, satins, dirt, and wax coatings. Surfaces shall remain dry for a minimum of 24 hours before the application of sealer and remain dry for 24 hours after the application of sealer.

B. Floor surface temperature must be above 50° F. and below 90° F.

C. Test on a small area before using to determine if the product is acceptable with type of stone.

D. A uniform coating of sealer shall be applied AFTER installation of stone materials. Install in strict accordance with Sealer manufacturer's recommendations.

3.7 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and installer ensuring dimension stonework being without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 14 21 00

ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Electric traction passenger elevators.

1.2 REFERENCES

A. ANSI/ASME A17.1 - Safety Code for Elevators and Escalators.

B. ISO 9001:2000 - Quality Management Systems - Requirements.

1.3 DESIGN REQUIREMENTS

A. Arrange elevator components in machine room, control room, or machinery space so equipment can be removed for repairs or replaced with minimal disturbance to other equipment and components.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer/installer's product data, including:
   1. Descriptive brochures or detail drawings of car and hall fixtures, cab ceilings, and product features.
   2. Power Information: Separate data sheets for horsepower, starting current, running current, machine and control heat release, and electrical requirements.

C. Shop Drawings: Submit manufacturer/installer's shop drawings, including plans, elevations, sections, and details, indicating location of equipment, loads, dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finish, options, accessories, and other information to render totally functional elevators.

D. Samples: Submit manufacturer/installer's samples of standard colors and finishes of finish materials.

E. Operation and Maintenance Manual: Submit manufacturer/installer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; renewal parts catalogs; and electrical wiring diagrams.

F. Warranty: Submit manufacturer/installer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer/Installer's Qualifications: Specialize in manufacturing and installing elevator equipment, with a minimum of 5 years successful experience.

B. Regulatory Requirements:
   1. Elevator design, clearances, construction, workmanship, materials, and installation, unless specified otherwise, shall be in accordance with ANSI/ASME A17.1, handicap accessibility, Americans with Disabilities Act, and other codes having legal jurisdiction.
   2. ANSI/ASME A17.1 shall govern, except where codes having legal jurisdiction include more rigid requirements or conflict with ANSI/ASME A17.1.
   3. Elevator shall follow design and manufacturing procedures certified in accordance with ISO 9001:2000 to meet product and service requirements for quality assurance for new products.

C. Pre-installation Meeting:
   1. Convene pre-installation meeting before start of installation of elevators.
   2. Require attendance of parties directly affecting work of this section, including Contractor, Architect, and elevator manufacturer/installer.
   3. Review examination, installation, field quality control, adjusting, cleaning, protection, and coordination with other work.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer/installer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

1.7 PROJECT CONDITIONS

A. Temporary Electrical Power:
   1. Arrange for GFCI-protected electricity to be available for installation of elevator components. Consult elevator manufacturer/installer for exact power demands and location for initial installation and hoisting. Once running work platform is achieved, bring temporary power to elevator disconnects with permanent characteristics for installation of remainder of elevator components.
   2. Comply with Section 01 50 00 - Temporary Facilities and Controls.

B. Temporary Use of Elevator:

1. Owner will negotiate with manufacturer/installer for temporary use of elevator, if required.
2. Temporary use of elevator shall be in accordance with terms and conditions of manufacturer/installer's temporary acceptance form.

1.8 SCHEDULING

A. Coordinate elevator work with work of other trades, for proper time and sequence to avoid construction delays.

1.9 WARRANTY

A. Manufacturer/installer shall guarantee materials and workmanship of equipment installed under these specifications and make good, defects not due to ordinary wear or to improper use, which may develop within 1 year after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

1.10 MAINTENANCE SERVICE

A. Elevator maintenance service shall be performed by elevator manufacturer/installer.

B. Elevators shall receive regular maintenance on each unit for period of 12 months after completion of work specified herein or acceptance thereof by beneficial use, whichever is earlier.

C. Trained employees shall make periodic examinations and perform work including necessary adjusting, greasing, oiling, and replacing parts to keep elevators in operation, except parts that require replacement because of accidents, vandalism, misuse, or negligence by parties other than manufacturer/installer.

D. Manufacturer/installer shall perform all Work, except emergency minor adjustment call-back service, during regular working hours. Manufacturer/installer shall provide emergency minor adjustment call-back service, during regular working hours.

E. Should Owner request that examinations, cleaning, lubrication, adjustments, repairs, replacements, or emergency minor adjustment call-back service, unless specified herein, be performed on other than manufacturer/installer's regular working hours of regular working days, manufacturer/installer shall absorb straight-time labor charges and Owner will compensate manufacturer/installer for overtime premium, travel time, and expense at normal billing rates.

F. Elevator Control System:
   1. Include built-in remote diagnostic module to relay constant status of elevators and control system to a 24-hour, 7-days-a-week, central-monitoring facility.
   2. Remote Monitoring Device: Transmit information on current status of

elevators, including malfunctions, system errors, and shutdown.

PART 2 PRODUCTS

2.1 MANUFACTURER/INSTALLER

A. Manufacturers:
   1. Kone.
   2. Schindler.
   3. ThyssenKrupp Elevator Americas.

B. Elevator shall be installed by elevator manufacturer.

2.2 ELEVATOR SYSTEM AND COMPONENTS

A. Elevator Equipment Summary:

1.	Application:	Machine Roomless unless noted otherwise.
2.	Counterweight Location:	Side.
3.	Service:	General Purpose Passenger.
4.	Quantity of Units:	Refer to Drawings.
5.	Capacity:	
	Stretcher-sized:	3500 lbs.
6.	Speed:	150 fpm.
7.	Travel:	Refer to Drawings
8.	Landings:	Refer to Drawings.
9.	Front Openings:	Refer to Drawings.
10.	Rear Openings:	Refer to Drawings.
11.	Operation:	Microprocessor Single Car Automatic Operation.
12.	Platform Size:	Per manufacturer.
13.	Door Type:	Single Speed Side Opening.
14.	Cab Height:	Per manufacturer.
15.	Guide Rails:	Per manufacturer
16.	Hoistway Entrances:	Per manufacturer.
17.	Power Supply:	480VAC, 3-Phase, 60 Hz.

B. Elevator Components:
   1. Braille and audible signals.
   2. Dispatch protection.
   3. Door nudging.
   4. Emergency Lighting.
   5. Emergency Power.
   6. Failed car.
   7. False car canceling.
   8. Firefighter's Service.
   9. Independent service.
   10. Infrared light curtain door protection.
   11. Inspection service.
   12. Load weigh bypass.

13. Locking service panel in car operating panel.
14. Remote monitoring capable.
15. Telephone, ADA compliant.

2.3 ELEVATOR MATERIALS

A. Finish:
   1. Stainless Steel and Bronze: No. 4 satin or No. 8 mirror finish.
   2. Baked Enamel Colors: Manufacturer/installer's standard color selections.
   3. Exposed Aluminum Frames in Suspended Ceilings: Anodized.

B. Plastic Laminates Used on Decorative Cab Panels:
   1. Type: General purpose.
   2. Flame Spread Ratings: As required by code.
   3. Pattern: Select from elevator manufacturer/installer's standard selection.

C. UL, CSA, or CUL Approved: Machines, microprocessor controller, controls, pushbuttons, and wiring.

D. Buffers, Attachment Brackets, and Anchors: Design and size according to building code with safety factors.

E. Machine:
   1. Gearless permanent-magnet AC motor with integral drive sheave and normal and emergency brakes.
   2. Mount to structural support channels or top of guide rail system as applicable in hoistway overhead.

F. Control Cabinet:
   1. Manual Brake Release Lever: Attach to control cabinet for rescue of passengers.
   2. Visual Display: Within control cabinet to indicate car position, speed, and direction.

G. Governor:
   1. Manual reset from outside hoistway.
   2. Mount to structural support channels or guide rail as applicable in hoistway overhead.

2.4 ELEVATOR CABS

A. Height: Refer to “Elevator Equipment Summary” in this Section.

B. Elevator Car Enclosure Wall Sections:
   1. Minimum 16-gauge (0.060-inch) steel panels, allowing maximum deflection of 3/4 inch.
   2. Cab Wall: The cab walls shall be steel, baked enamel finish with plastic laminate raised panels.

C. Base, Frieze, and Reveals: Baked enamel.

D. Ceiling:
   1. Suspended with exposed frame with plastic lay-in panels.
   2. Lighting: Fluorescent.

E. Cab Returns: Integral construction.
   1. Finish: No. 4 stainless steel.

F. Transoms:
   1. Run full width of cab.
   2. Finish: No. 4 stainless steel.

G. Cab Doors:
   1. Flush design both sides.
   2. Rib Construction.
   3. Finish: No. 4 stainless steel.

H. Infrared Light Curtain Door Protection:
   1. Equip leading edges of car doors with concealed transmitter and receiver infrared beam devices to detect presence of object in process of passing through hoistway entrance and car doorway.
   2. Use multibeam scanning without moving parts to detect obstructions in door opening.
   3. Detector Device: Prevent doors from closing, or if they have already started closing, cause doors to reopen and remain open while object is within detection zone.
   4. Horizontal Beams: Minimum of 40 horizontal beams to fill doorway from ground level to a height of 6 feet.

I. Exhaust Fan:
   1. Single speed.
   2. Mount in canopy.

J. Handrail:
   1. 1/2 inch x 2 inch flat in brushed aluminum.
   2. Mount on rear wall.

K. Threshold: Aluminum.

L. Cab Finish Flooring: As specified in Interior Design Drawings. Fabricate cab floor to receive specified finish flooring.

2.5 HOISTWAY ENTRANCES

A. Hoistway Doors and Frames:
   1. UL rated with required fire rating.

2. Doors: Rigid flush panel construction with reinforcement ribs.
3. Frames: Securely fasten at corners to form unit frame. Frames shall be bolted.

B. Finish:
1. Exposed Areas of Corridor Frames: Baked enamel primer on all floors.
2. Doors: Baked enamel primer on all floors.

C. Sills: Aluminum on all floors.

2.6 CAB FIXTURES

A. Main Car Operating Panel:
1. Mount in return.
2. Comply with handicap requirements.
3. Pushbuttons: Illuminate using long-lasting LEDs included for each floor served.
4. Emergency Buttons and Switches: Provide in accordance with code.
5. Switches for car light and accessories.

B. Cab Fixtures:
1. Car Lantern(s).
2. Digital Car Position Indicator.
3. Locking Service Panel in Car Operating Panel.
4. Telephone (ADA compliant).

2.7 HALL FIXTURES

A. Pushbuttons:
1. Up button and down button at intermediate floors.
2. Single button at each terminal floor.
3. Height: Comply with handicap requirements.
4. Illumination: Illuminate using long-lasting LEDs.

B. Hall Fixture Finish: Black lexan.

C. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings. Provide [one of] following:
1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units mounted in both jambs of entrance frame.

D. Fixture Cover Plates: Mount with tamper-resistant screws in same finish as fixture.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine hoistways, hoistway openings, pits, and machine rooms or control rooms before starting elevator installation.

B. Verify hoistway, pit, machine room or control room, and openings are of correct size, within tolerances, and are ready for work of this Section.

C. Verify walls and sill supports are plumb, where openings occur.

D. Verify hoistway is clear and plumb, with variations not to exceed 1 inch at any point in first 100 feet. Increase tolerance at 1/32 inch for each additional 10 feet, up to a maximum of 2 inches.

E. Verify minimum 2-hour fire-resistance rating of hatch walls.

F. Notify Architect in writing of dimensional discrepancies or other conditions detrimental to proper installation or performance of elevators.

G. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to manufacturer/installer.

3.2 INSTALLATION

A. Install elevators in accordance with manufacturer/installer's instructions and ANSI/ASME A17.1.

B. Set entrances in vertical alignment with car openings, and aligned with plumb hoistway lines.

3.3 FIELD QUALITY CONTROL

A. Perform tests of elevator as required by ANSI/ASME A17.1 and governing codes.

3.4 ADJUSTING

A. Adjust elevators for proper operation in accordance with manufacturer/installer's instructions.

B. Adjust elevators for smooth acceleration and deceleration of car so not to cause passenger discomfort.

C. Adjust doors to prevent opening of doors at landing on corridor side, unless car is at rest at that landing, or is in leveling zone and stopping at that landing.

D. Adjust automatic floor leveling feature at each floor to within 1/4 inch of landing.

E. Repair minor damages to finish in accordance with manufacturer/installer's instructions and as approved by Architect.

F. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.5 CLEANING

A. Clean elevators promptly after installation in accordance with manufacturer/installer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.6 PROTECTION

A. Protect installed elevators from damage during construction.

END OF SECTION

SECTION 21 00 00

FIRE PROTECTION GENERAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Architect shall be notified of the discrepancy.

D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of the following sections:

1. Section 22 00 00 - Plumbing General
2. Section 23 00 00 - HVAC General
3. Section 26 00 00 - Electrical General

1.02 SYSTEMS

A. Systems to be provided under the Fire Protection design section shall be as listed below. The connection point to the site utility service for the fire protection system shall be at 5'-0" from the exterior of the building unless specifically otherwise noted.

1. Automatic Sprinkler Systems
2. Combination Standpipe/Automatic Sprinkler Risers
3. Automatic Dry Sprinkler Systems
4. Fire Department Valve Cabinets
5. Painting of exposed piping

1.03 QUALIFICATION OF CONTRACTORS

A. The Contractor for the fire protection installation shall be a certified fire protection contractor, licensed for the installation of automatic fire sprinkler systems and other fire protection equipment.

1.04 DESIGN STANDARDS

A. Fire Protection systems shall be designed and installed in accordance with the requirements of the following codes, standards and design guides:

1. The International Fire Prevention Code, 2012 Edition, with most current Georgia Amendments
2. The International Building Code, 2012 Edition, with most current Georgia Amendments
3. National Fire Protection Association (NFPA) Standards:
    a. NFPA 101 - Life Safety Code - 2012 Edition
    b. NFPA 13 - Installation of Sprinkler Systems - 2010 Edition
    c. NFPA 13R - Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height - 2010 Edition
    d. NFPA 14 - Installation of Standpipe and Hose Systems - 2010 Edition
    e. NFPA 20 - Installation of Centrifugal Fire Pumps - 2010 Edition
    f. NFPA 24 - Installation of Private Fire Service Mains - 2010 Edition
    g. NFPA 25 - Inspection, Testing, and Maintenance of Water-based Fire Protection Systems - 2011 edition
4. Factory Mutual (FM) Approval Guide
5. Underwriters Laboratories Inc. (UL)
6. Owner’s Insurance Underwriter Requirements

B. Design Criteria

1. Upon award of the Contract, a new flow test from the two (2) hydrants nearest the site service entry is to be performed by the Contractor to confirm the flow and pressure characteristics of the existing water service. The completed flow test data along with a utility service map of the area is to be forwarded to the Engineer for confirmation of the existing water service.
2. The entire facility will be protected by an automatic sprinkler system supplied by combination fire standpipe/automatic sprinkler systems located within the building stairwells.
3. Automatic sprinkler systems shall be designed to the available domestic water pressure available and shall be hydraulically calculated for the following design standards:

a. NFPA 13 Systems

Area/Usage	Hazard Classification	Density GPM/Sq. Ft.	Remote Area	Maximum Head Spacing	Interior Hose Stream
Public Spaces, Lobbies, Corridors, Offices, Restaurants, Lounges, Meeting Rooms and Units	Light	.10	1,500 sq. ft.	225 sq. ft.	100 gpm
Mechanical Rooms, Electrical Rooms, Elevator Equipment Rooms, Maintenance / Storage Rooms, Kitchen / Food Service Areas and Laundry	Ordinary Group 1	.15	1,500 sq. ft.	130 sq. ft.	250 gpm
Ballrooms, exterior loading docks (see NFPA 13-A5.3.2)	Ordinary Group 2	.20	1,500 sq. ft.	130 sq. ft.	250 gpm
Dry Pipe Systems: Parking Garages, Non-heated Attic Spaces, Ceiling Spaces, Porte Cochere and other spaces containing sprinkler piping that do not have alternate provisions to guarantee a 40° F temperature.	Ordinary Group 1	.15	1,950 sq. ft.	130 sq. ft.	250 gpm

b. NFPA 13R Systems:

1) Residential Sprinklers

a) The system shall provide at least the flow required for the multiple and single sprinkler operating criteria specified by the sprinkler listing.

b) The system shall provide at least the flow required to produce a minimum discharge density of 0.05 gpm/sq. ft. (2.04 mm/min) to the design sprinklers.

c) Number of Design Sprinklers. The number of design sprinklers under flat, smooth, horizontal ceilings shall include all sprinklers within a compartment that requires the greatest hydraulic demand, up to a maximum of four adjacent sprinklers.

4. The fire protection systems shall not be designed to operate if the residual pressure of the existing water service falls to 20 psi or lower at design flow requirements.
5. The fire protection system design shall include a minimum of 10 psi safety factor to allow for future losses in the water service pressure characteristics.
6. The maximum allowable system velocities shall not exceed 20 fps unless alternate criteria are required by the Owner's Insurance Underwriter.
7. The Dwelling Units automatic sprinkler design criteria may be hydraulically calculated for the room design method as outlined in NFPA

13 if acceptable to the local governing authorities and the Owner's Insurance Underwriter.

8. Dwelling Units shall be completely protected by automatic sprinklers.
9. Shelled areas for future tenant fit-up sprinkler systems shall be designed based on a maximum of 140 square feet per sprinkler or 256 square feet for extended coverage. When sprinklers are exposed, branch line connections for sprinklers shall be a minimum of 1" size with 1" sprigs to upright sprinklers or 1" drops to pendent sprinklers to accommodate tenant fit-up.
10. Reasonable efforts shall be made to identify water supplies that could lead to microbial induced corrosion (MIC). When conditions are found that may result in MIC contamination of the fire protection piping, corrective measures shall be designed.

C. Combination Standpipe/Automatic Sprinkler Risers

1. Combined standpipe/sprinkler risers or Class I standpipe risers with fire department valves shall be installed in each stairwell within the facility. Automatic sprinkler connections will be supplied from combined standpipe/sprinkler risers with a floor control valve assembly, including check valve, at the required locations. Additional standpipes with 2-½" fire department valves are to be provided at required locations throughout the facility per the requirements of NFPA 14.
2. Temporary standpipes must be provided during construction and installed before progress of construction exceeds 40 feet in height.
3. Standpipes will be designed to provide a minimum of 500 gpm. Fire mains supplying standpipes will be hydraulically designed and sized to provide a minimum of 500 gpm at the most remote standpipe and 250 gpm for each additional standpipe to a maximum of 1,000 gpm.
4. A two-outlet roof manifold complete with fire department valves, caps and chains, automatic ball drip, and isolation valve in a heated space shall be provided for each standpipe and located on the roof, at the roof area adjacent to the roof access point, or at the highest landing of stairwells with stair access to the roof.
5. The fire protection system shall provide 100 psi at the most remote fire department connection; 65 psi may be allowed as a deductive alternate where acceptable to the local authorities and all applicable Owner design criteria.
6. Standpipes and/or sprinkler connections that are equipped with pressure regulating valves shall be provided with 3" drain risers.

D. Fire Protection System Alarms

1. The fire protection contractor shall coordinate location and function of all flow, air pressure, supervisory switches, and other dry contacts with the fire alarm contractor.

2. All control valves in the fire protection system shall be provided with supervisory switches wired for annunciation at the main FACP.
3. Automatic sprinkler system connections shall be provided with flow switches adjacent to the zone control valve wired for annunciation at the main FACP.
4. Automatic sprinklers will be provided in all elevator shafts and elevator machine rooms as required. The service to each of these spaces shall be provided with an individual control valve with a supervisory switch and a flow switch (with no retard built into it) located in an adjacent room and wired for annunciation at the main Fire Alarm Control Panel (FACP).

1.05 ORDINANCES, PERMITS AND DRAWING APPROVALS

A. The Contractor shall file all requisite plans relating to this section of the specifications with the proper authorities, secure all permits and approvals and pay all resultant fees for work done under this section.

B. All fire protection work shall comply with all laws, ordinances, rules, regulations and standards of the City, County, State and the Owner's Insurance Underwriter; all applicable sections of the National Fire Codes and the Codes and Standards of the National Fire Protection Association.

C. If code or other requirements exceed the provisions shown on the Contract Documents, the Architect shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.06 EQUIPMENT, MATERIALS, BID BASIS

A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in the Specifications or on the Drawings as "base" products.

C. "Equal product" and "approved equal" items listed shall conform to specified base items and shall be substantially equal in size, weight, construction quality and capacities. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question.

D. The Contractor shall coordinate the installation of all fire protection equipment proposed for use in this project with all building trades (architectural, structural

and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost.

1.07 EXAMINATION OF EXISTING PREMISES

A. Prior to the ordering or purchasing of any equipment or materials or the layout or installation of any work, the Contractor shall examine the premises and verify any and all of the existing conditions under which he will be obliged to operate, or that will in any manner affect the work under this Contract. No allowance will be made subsequently in this connection in behalf of the Contractor.

1.08 PAINTING

A. All piping exposed to public sight such as standpipe and drain piping in stairwells, or exposed to exterior or moisture conditions such as piping in parking decks, shall be primed and painted with two coats of an enamel-based paint. The color shall be as directed by the Architect.

B. Contractor shall touch-up to match original finish any equipment scratched in shipment or installation.

1.09 TRANSPORTATION, DELIVERY, STORAGE AND PROTECTION

A. The Contractor shall provide and pay for all transportation, delivery, and storage required for all equipment and materials. Upon receipt of all equipment and materials, they shall be properly stored in their original shipping container to protect them from vandalism, theft, the elements, and other harm or damage. Any equipment or materials received in a damaged condition, or damaged after receipt, shall not be installed. Only new undamaged equipment in first-class operating condition shall be installed.

B. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

C. The Contractor shall closely coordinate the ordering and delivery of all mechanical equipment with other trades to assure that equipment will be delivered in time to be installed in the building without requiring special or temporary access or building modifications. Certain equipment may have to be installed prior to the erection of the building walls or roofs.

1.10 GUARANTY

A. All fire protection work described in the Contract Documents shall be guaranteed for a period of one (1) year from the date of final acceptance. This guaranty shall

apply to all equipment, materials and workmanship. During the guaranty period, all defects shall be corrected in an acceptable manner, consistent with the quality of materials and workmanship of original construction, at no expense to the Owner.

1.11 SHOP DRAWINGS

A. It is the responsibility of the Contractor to coordinate the design with the work of all other disciplines so as to avoid conflicts. Where necessary piping shall be offset around ducts, structural members or other obstructions, while maintaining effective coverage, drains shall be provided per NFPA requirements.

B. Review of the Drawings and hydraulic calculations by Jordan & Skala Engineers, Inc. (JSE) is for coordination with the design concept for the project, and for assurance that they have been prepared in a timely manner. JSE is entitled to rely on the technical sufficiency and timely delivery of these documents, as well as on the computations performed by the subcontractor. JSE shall not be required to review or verify those computations or designs for compliance with applicable laws, statutes, ordinances, building codes, and rules and regulations.

C. All required submittals shall be transmitted electronically (e.g. pdfs, etc.) with the associated specification section and the item submitted clearly identified. The Contractor shall provide an itemized listing, which indicates the horsepower and voltage of each piece of equipment that requires electrical service. The itemized list is to be signed by the project managers of the Contractor, Electrical Contractor and General Contractor to ensure coordination of the electrical requirements for the project. Review of the equipment submittal will not begin until the electrical coordination document is provided.

D. All fire protection drawing submittals shall be at 1/8" scale as a minimum.

E. Fire Protection shop drawings shall include all data required by NFPA Section 13. Shop drawing plans shall indicate all lights, grilles, soffits, alarms, speakers and other ceiling components, as well as hydraulic node points, to ensure coordination. Substitutions or alterations to the design included in the Contract Documents shall be clearly stated on the shop drawing submittal. The Contractor shall submit shop drawings to and secure approval of the Owner's Underwriter, local authority and/or state authorities prior to submission to the Engineer. The Contractor shall not commence work, purchase, or provide any materials to the job site without obtaining shop drawing approval. Shop drawings shall include copies of all hydraulic calculations providing design densities, where applicable. In addition, shop drawings submittals shall include printed catalog specifications and data sheets for all of the following as applicable:

1. Fire pump and controller
2. Jockey pump and controller

3. Fire department valves
4. Sprinkler heads and accessories
5. Siamese Fire Department connection
6. Fire valve cabinets
7. Test header
8. Roof manifold
9. Backflow preventer
10. Cutting oil indicating compatibility with the CPVC sprinkler piping

F. A letter signed by an officer of the Contractor's company shall be included in the submittal book that states the following items meet or exceed the requirements of the specifications:

1. Pipe and fittings
2. Valves
3. Pipe supports
4. Pipe accessories
5. Pipe labels and valve tags
6. Flow switches
7. Tamper switches

G. All design drawings and calculations prepared by the Contractor shall bear the seal of a registered professional or fire protection engineer or NICET Level IV certification licensed in the state of the project or equivalent fire sprinkler contractor's certificate seal.

H. Included with submittals of fire protection equipment requiring electrical connections shall be a written statement confirming coordination of voltage requirements, bearing the names and signatures of the fire protection and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the electrical drawings, as well as with the electrical contractor.

Fire Protection Contractor:_____

Project Manager Name:_____

Project Manager Signature/Date:_____

Electrical Contractor:_____

Project Manager Name:_____

Project Manager Signature/Date:_____

I. Provide Material Safety Data Sheet (MSDS) or letter from manufacturer certifying the VOC content for each adhesive, sealant, paint and coating.

J. VOC Content: Submit adhesive and sealants product information or MSDS showing VOC Content information for all applicable products specified under this section. All applicable products in this section must meet low VOC content as specified by LEED Specification Section 01 81 13 Sustainable Design Requirements.

1.12 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes to indicate actual final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of 1/8" scale.

B. The original set of “as-built” drawings shall be scanned and transmitted to the Architect in CD or flash drive format along with the original “as-built” documents.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Prior to final acceptance by the Owner, the Contractor shall provide three (3) copies of an Operations and Maintenance Manual, Bound, indexed, and titled in three-ring, loose-leaf binders and one flash drive. These manuals shall each contain the following:

1. Clear and concise instructions for operation, maintenance, adjustment, lubrication, wiring diagrams and trouble-shooting data for all mechanical equipment. This information shall be prepared by the manufacturer for particular size and model of equipment furnished.
2. Parts list of all parts for equipment, with catalog numbers and other data necessary for ordering of replacement parts.
3. Provide a competent manufacturer’s service engineer for a minimum of two (2) days to instruct the operating personnel including the interpretation of all equipment diagrams. A diary of the training sessions shall be made by the instructing manufacturer’s service engineer and witnessed by the Owner’s representative and shall be included in the as-built submittal.
4. Copies of all approved equipment shop drawings, sprinkler layout drawings, hydraulic calculations and as-built plans shall be submitted with the Operation and Maintenance manual.

5. Index shall include type of equipment, manufacturer, and local representative with address and phone number.

PART 2 - PRODUCTS

2.01 FIRE PROTECTION SYSTEM MATERIALS

A. All materials, pipe, valves and equipment furnished under this section shall be new and approved by NFPA, Underwriters Laboratories Inc. (UL), Factory Mutual (FM) and American Water Works Association (AWWA) where applicable.

B. The proposal submitted shall include all materials and equipment as specified or shown on the Drawings. Proposed substitutions with difference in price, if any, shall be listed separately on the bid form at the time of submittal.

C. Required materials not covered by the detailed specifications shall be of a suitable class, grade and type and shall be subject to the approval of the Engineer. Where two or more units of the same class or type of equipment are required, these units shall be the products of a single manufacturer.

2.02 PIPE, JOINTS AND FITTINGS

A. Underground Piping

1. Class 50 and 51 ductile iron pipe, bituminous coated outside, cement lined interior, ANSI A21.51 and A21.4
   a. Push-on or mechanical joints with neoprene gasket, 250 psi rating, ANSI A21.11
   b. Ductile iron mechanical joint fittings with neoprene gasket, bituminous coated outside, cement lined interior, 250 psi rating, ANSI A21.10
   c. Ductile iron flanged joints for all piping in vaults, red rubber gaskets, 250 psi rating, ANSI A21.15. Cadmium plated heavy hex machine bolts and nuts with bituminous coating field applied.
2. Class 150 polyvinyl chloride (PVC) DR 18 pressure pipe, NSF and Factory Mutual approved, AWWA C900
   a. Push-on or mechanical joints with neoprene gasket, ASTM D3139 and ANSI A21.11
   b. Ductile iron mechanical joint fittings with neoprene gasket, bituminous coated outside, cement lined interior, 250 psi rating, ANSI A21.10
   c. Ductile iron flanged joints for all piping in vaults, red rubber gaskets, 250 psi rating, ANSI A21.15. Cadmium plated heavy hex machine bolts and nuts with bituminous coating field applied.

3. Underground piping and installation shall be in accordance with the Insurance Underwriter's requirements and NFPA-24 and shall be installed with a minimum of 2'-6" of cover.
    a. Trenching conditions for ductile iron pipe shall be Type 1 laying condition, ANSI A21.50.
    b. Trenching conditions for PVC pipe shall be Class C bedding, ASCE Manual #37, and manufacturer's recommendations.

B. Aboveground Piping

1. Schedule 40 welded or seamless steel pipe, ASTM A53 and A135, and A795. In accordance with NFPA 13, piping with threaded joints 6" and smaller shall be Schedule 40, piping 8" and larger may be Schedule 30 minimum. For welded or roll-grooved joints, wall thickness shall be Schedule 7 minimum for piping 4" and smaller, 0.134" for 6" pipe, and 0.188 for 8" and 10" pipe. Schedule 80 pipe shall be used when working pressures exceed 300 psi.
    a. Class 125 and 250 cast iron threaded fittings, ANSI B16.4
    b. Class 150 and 300 malleable iron threaded fittings, ANSI B16.3
    c. Class 125 and 250 cast iron flanged fittings, ANSI B16.1
    d. Schedule 40, 150 psi, forged steel buttweld fittings, ANSI B16.9
    e. Grooved mechanical couplings and fittings with EPDM center-leg gasket, ductile iron, 300 psi minimum rating ASTM A536, UL Listed, FM Approved
        1) In applicable sizes, fittings shall be short-pattern, with flow equal to standard pattern fittings. Basis of Design: Victaulic FireLock or approved equal.
        2) Installation-Ready™ fittings for Schedule [40] [10] grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½. Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, [orange enamel coated] [red enamel coated] [galvanized]. Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi and FM approved for working pressure 365 psi.
    f. All cutting oils, thread sealants and other products must be compatible with the CPVC piping installed.
2. Schedule 10 minimum lightwall welded or seamless steel pipe with corrosion resistant coating, CRR Value of 1 minimum, ASTM A53 and A135
    a. Grooved mechanical couplings and fittings with EPDM center-leg gasket, ductile iron, 300 psi minimum rating ASTM A536, UL Listed, FM Approved

1) In applicable sizes, fittings shall be short-pattern, with flow equal to standard pattern fittings. Basis of Design: Victaulic FireLock or approved equal.

2) Installation-Ready™ fittings for Schedule [40] [10] grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½. Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, [orange enamel coated] [red enamel coated] [galvanized]. Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi and FM approved for working pressure 365 psi.

b. Lightwall, 150 psi, buttweld fittings, ANSI B16.9

3. Chlorinated polyvinyl chloride (CPVC) pipe, ASTM D1784 and F442, UL Listed, plenum rated
   a. Schedule 40 & 80 chlorinated polyvinyl chloride (CPVC), solvent welded socket, ASTM F439, UL Listed, plenum rated
   b. Schedule 40 & 80 chlorinated polyvinyl chloride (CPVC), threaded, ASTM F437, UL Listed, plenum rated
   c. CPVC piping is not to be installed in areas of exposed construction. Provide steel pipe and fittings in all areas where piping is exposed.
4. Dry Systems
   a. Schedule 40 welded or seamless internally and externally galvanized steel pipe, ASTM A53 and A135.
   b. Schedule 10 minimum lightwall welded or seamless steel pipe with corrosion resistant coating, CRR Value of 1 minimum, ASTM A53 and A135 may be considered as a deductive alternate.
   c. Class 150 and 300 internally and externally galvanized malleable iron threaded fittings, ANSI B.16.3
   d. Grooved mechanical couplings and fittings with EPDM flush gap or center-leg gasket, galvanized ductile iron, 800 psi minimum rating, ASTM A536, UL Listed, FM Approved
   e. Provide chromium plated zinc or other approved corrosion prohibitant at all non-galvanized pipe threads, bolts and other areas to maintain the integrity of the galvanized system.

      1) In applicable sizes, fittings shall be short-pattern, with flow equal to standard pattern fittings. Basis of Design: Victaulic FireLock or approved equal.

      2) Installation-Ready™ fittings for Schedule [40] [10] grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½. Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, [orange enamel coated] [red enamel coated] [galvanized]. Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM A449 electroplated steel bolts

and nuts. System shall be UL listed for a working pressure of 300 psi and FM approved for working pressure 365 psi.

5. Flexible stainless-steel piping connection, UL Listed and FM Approved, 1" NPS corrugated braided stainless-steel hose assembly, a bend radius to 2", UL Listed to 175 psi rating and FM Approved to 200 psi.
   a. Victaulic Vic-Flex Series or approved equal.

C. All interior sprinkler piping shall meet the requirements of applicable sections of NFPA, and the Owner's Underwriter. All pipe, fittings, valves, and sprinkler system components shall be rated for working pressures as required by system design.

D. Grooved Joint Couplings: Couplings consist of two ductile iron housing segments, pressure responsive elastomer gasket, and ASTM A449 compliant bolts and nuts.

1. Rigid Type: Housings cast with offsetting, angle-pattern, bolt pads to provide system rigidity and support and hanging in accordance with NFPA-13, fully installed at visual pad-to-pad offset contact. (Couplings that require exact gapping at specific torque ratings are not permitted.). Installation-Ready for complete installation without field disassembly. Basis of Design: Victaulic Style 009N and 107N or approved equal.
2. Flexible Type: For use in locations where vibration attenuation and stress relief are required: Basis of Design: Victaulic Installation-Ready Style 177 or Style 77 or approved equal.

E. All pipe, supports and hanger assemblies shall be in accordance with NFPA-13 and shall be UL Listed or FM Approved.

F. All sprinkler hangers and support rods installed in areas exposed to exterior conditions, including parking decks, are to be fully galvanized or painted with two coats of Adsil Microguard corrosion prohibitor.

G. All fire protection system components shall be of the required pressure rating to eliminate the requirement for a main relief valve on the fire pump.

2.03 VALVES AND ACCESSORIES

A. Valves shall be installed where shown on the Drawings and elsewhere as required by codes or standards. All valves shall be UL Listed or FM Approved for fire protection service. All valves shall be provided with remote alarm tamper switches compatible with the Owner's central alarm system to monitor valve tampering. All switches and systems shall be Class B supervised. Provide 250 and 300 psi rated components at all locations as required by system pressure.

1. Gate Valves
   a. 2-1/2" and larger, Class 175 or 300, iron body, bronze mounted, solid wedge, outside screw and yoke, flanged or grooved ends, Stockham G-634 or F-670, or Victaulic Series 771 rated to 250 psi listed for fire service
   b. 2" and smaller, Class 175, bronze body and trim, solid wedge, outside screw and yoke, threaded ends, Stockham B-133
   c. Provide UL Listed pressure regulating valves at all locations required due to system pressure. Valves shall be Potter Roemer Series 4000 or approved equal.
2. Butterfly Valves
   a. 2” through 12”, 300-psi, grooved-end ductile iron body, electroless-nickel coated ductile iron disc, pressure responsive elastomer seat, with stainless steel stem. (Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.) Weatherproof actuator housing with handwheel and supervisory switches. Valve shall be Victaulic Series 705.
   b. 4" and larger, Class 175, iron body, aluminum bronze disc, wafer or lug style, EPDM gasket, Stockham LG-52U
   c. 2" and smaller, Class 175, bronze body, stainless steel disc threaded ends, Milwaukee BB-FP
3. Check Valves
   a. 2-1/2" and larger, Class 125, iron body, bronze disc, flanged or threaded ends, Stockham G-931 and G-927
   b. 2-1/2" and larger, Class 125, iron body, bronze trim, flanged ends, Milwaukee 1800 series, flanged, UL Listed for fire service
   c. 2” through 12”, 250-psi, grooved-end ductile iron body, stainless steel spring and shaft for vertical or horizontal installation. Valves shall be Victaulic Series 717.
   d. 4" and larger, Mission fig. U-12 HMP, wafer body, UL Listed for fire service
4. Backflow Preventers
   a. Double check assembly shall be a complete assembly with two (2) independently operating check valves mounted in a common body, two (2) gate valves and four (4) test cocks, designed for horizontal installation. All valves shall be provided with tamper switches. The complete assembly shall be UL Listed, FM Approved, designed to specifications and/or requirements of USC, CCCL, AWWA and ASSE and shall be sized for the full fire flow demand at a maximum of 6 psi pressure drop.
      1) Double check backflow preventers shall be ASSE 1015 certified and equal to Ames Maxim M200, Watts Series 757, Zurn 350A or approved equal.
      2) Double detector check backflow preventers shall be provided where required by local authorities, ASSE 1048

certified and equal to Ames Maxim M300, Watts Series 757DCDA, Zurn 350DA or approved equal.

5. Fire Department Valves
   a. Fire Department valve shall be 2-1/2" cast brass body, 300 lb. rating, female N.P.T. inlet, male hose thread outlet, complete with cap and chain, brass finish. Valve shall be Potter Roemer Fig. 4065 or approved equal.
   b. Provide UL Listed pressure regulating valves at all locations as required by system pressure. Valve shall be Potter Roemer 4000 Series or approved equal.
6. Floor Control Valve
   a. The floor control valve assembly shall be provided with a valve with supervisory switch. A check valve, pressure gauge, water flow switch and test connection with drain shall be provided downstream. The installation shall be per NFPA 13 requirements.
   b. Provide UL Listed pressure regulating valves at all locations as required by system pressure. Valve shall be Potter Roemer 4000 Series or approved equal.
7. Siamese Fire Department Connection
   a. Fire department connection shall be 2-way exposed Siamese type, 2-1/2" x 2-1/2" x 4" size, cast brass body, polished chrome finish for all exposed surfaces, cast brass escutcheon, and brass female hose inlets having individual clapper valves, plugs, and chains. Assembly shall be located with the center line of the hose inlets at 2'-6" above adjacent grade. Inlet threading shall be National Standard or same as municipal fire department, as required. Assembly shall be UL Listed, FM Approved. Wall Mounted: Potter Roemer 5710 series or approved equal.
   b. Free Standing: Potter Roemer 5760 series or approved equal.
   c. At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for localized system drainage. Basis of Design: Victaulic #10-DR.
8. Fire Valve Cabinet
   a. Cabinet shall be 20-gauge steel with polyester coating, recessed with flush full metal hinged door with cam catch and integral shelf for fire extinguisher. Cabinet shall be Potter-Roemer 1870 series or approved equal.
9. Roof Manifold
   a. Wall mount manifold to be three outlet horizontal configuration, cast brass body with threaded 2-1/2" male outlets complete with valves, chains and caps, rough brass finish. Provide accessible indicating type shut off valve with supervisory switch (normally closed) and automatic ball drip to roof. Roof manifold to be Potter-Roemer 5880 series or approved equal.

2.04 AUTOMATIC SPRINKLER SYSTEM MATERIALS

A. The underground fire protection service shall be provided with thrust blocks and rods and clamps at the service entry.

B. Automatic sprinklers shall be provided as follows:

1. Dwelling Units
   a. Small frame glass element, semi-recessed or flat plate concealed pendent and sidewall sprinklers shall be provided in all areas with ceilings as indicated on the Drawings. Temperature rating of sprinklers shall be 155 - 165 degrees. Sprinkler and escutcheon or concealed cover plate to be white finish. Sprinkler to be Viking Freedom Residential series or equal with listed and/or approved semi-recessed escutcheon or concealed cover plate.
2. Dwelling Unit Corridors
   a. Small frame glass element, semi-recessed or flat plate concealed pendent and sidewall sprinklers shall be provided in all areas. Temperature rating of sprinklers shall be 155 – 165 degrees. Sprinkler and escutcheon or concealed cover plate to be white finish. Sprinkler to be Viking Freedom series or equal with listed and/or approved semi-recessed escutcheon or concealed cover plate.
3. Public Spaces with Gypsum Ceilings
   a. Fully flat plate concealed type sprinklers, glass element, or fusible link style, quick response sprinklers shall be provided in all areas with gypsum ceilings unless otherwise noted. Temperature rating of sprinklers shall be 155 – 165 degrees. Concealed cover plate shall be factory painted to match the adjacent ceiling color; submit painted sample to the Architect for approval. Sprinkler to be Viking Mirage or equal concealed sprinkler or approved equal.
   b. Small frame glass element, semi-recessed, quick response pendent sprinklers shall be provided in all areas with gypsum ceilings unless otherwise noted. Temperature rating of sprinklers shall be 155 – 165 degrees. Sprinkler and escutcheon to be white finish. Sprinkler to be Viking Microfast series or equal with listed and/or approved semi-recessed escutcheon.
4. Public and Back-of-House Spaces with Lay-in Ceilings
   a. Small frame glass element, semi-recessed, quick response pendent sprinklers shall be provided in all areas with lay-in ceilings unless otherwise noted. Temperature rating of sprinklers shall be 155 – 165 degrees. Sprinkler and escutcheon to be white painted finish. Sprinkler to be Viking Microfast series or equal with listed and/or approved semi-recessed escutcheon.
5. Back-of-House Spaces and Unfinished Spaces with no Ceiling
   a. Quick response upright pendent sprinklers shall be provided in all areas with no ceiling. Temperature rating is to be 165 degrees

unless conditions require higher temperature. Finish of sprinkler to be rough brass. Sprinkler to be Viking Microfast or equal.

6. Parking Garages and Other Areas Exposed to Exterior Conditions
   a. Quick response upright sprinklers shall be provided in areas exposed to exterior conditions, supplied from the dry pipe system. All sprinklers shall have UL Listed ENT, polyester or Teflon corrosion protection. Temperature rating is to be 165 degrees unless conditions require higher temperature. Sprinkler to be Viking Microfast or equal.
7. Exterior Overhangs and Elevator Shafts
   a. Quick response chrome plated dry horizontal sidewall or upright sprinklers are to be provided. Barrel length shall be a minimum of 12". Sprinkler and escutcheon shall have UL Listed ENT, polyester or Teflon corrosion protection at exterior overhangs and rough brass finish at elevator shafts. Sprinkler shall be Viking Microfast or equal.
8. Interstitial Spaces
   a. Combustible interstitial (concealed) spaces (i.e. between floors as well as low pitch attics that meet NFPA's definition of such spaces shall be protected by sprinklers designed for use in these areas per the manufacturer's data pages. All sprinklers shall be UL Listed specifically listed for use in Light Hazard combustible and non-combustible concealed spaces with extended coverage listings for spacing up to 16' x 16'. Sprinklers shall be listed for use with wet pipe systems using steel or any listed CPVC pipe, or dry pipe system using steel pipe. QR combustible concealed space sprinklers shall be installed in accordance with the manufacturer's guidelines. Sprinkler shall be Viking COIN quick response upright sprinklers (specific application) VK950.
9. Exterior Balcony or Breezeway
   a. Victaulic VicFlex™ dry horizontal sidewall or pendant sprinkler, Model VS1. The sprinkler shall provide a vertical or horizontal flexible connection with a bend radius to 2", and allow for up to 4 bends.
10. Alternate acceptable manufacturers with equivalent sprinkler are Victaulic, Reliable, or Globe.
11. Sprinkler guards shall be installed on all sprinklers 7'-0" or less above floor.
12. Provide sprinklers at the highest and lowest level of all stairwells.
13. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
14. Provide sidewall sprinklers at the top end and bottom of all elevator hoistways. Sprinklers may be omitted from traction elevators on non-combustible elevator shafts and cabs which meet the requirements of ASME A.17.1 and where acceptable to the local authorities.

15. Sprinklers shall be prohibited in elevator machine rooms, elevator machine spaces and elevator hoistways of fire service access elevators.
16. Provide sprinklers in electrical rooms and elevator machine rooms unless specifically prohibited by local authorities; the sprinkler supply to each space shall be provided with a supervised valve and flow switch. Coordinate the intermediate temperature rating of the sprinkler head in all elevator machine rooms with the electrical contractor to ensure sprinkler operation will not occur prior to activation of the heat detector and the shunt trip circuit breaker.
17. Sidewall sprinklers shall be installed in all electrical rooms, electrical closets and elevator machine rooms where adequate coverage is provided. Upright sprinklers shall be installed in these spaces when coverage limitations of the sidewall sprinklers are exceeded. Piping shall not be installed above any electrical equipment, switchboard or panelboard. Piping shall offset around surface mounted light fixtures where possible, provide a minimum of 6" clearance below the bottom of the light fixtures at all locations.
18. The property is to be fully sprinklered throughout per the requirements of NFPA unless specifically noted otherwise. Elimination of sprinklers in electrical rooms, elevator shafts and elevator machine rooms shall be clearly indicated on the shop drawing submittal noting the exception applied for the deletion of sprinklers in these spaces.
19. The Contractor shall furnish and install a cabinet located in the fire service entry room with the quantity of each type of sprinklers and wrenches as required by NFPA 13:
    a. facilities with less than 300 sprinklers 6 minimum
    b. facilities with 300 to 1000 sprinklers 12 minimum
    c. facilities with over 1000 sprinklers 24 minimum
20. The Contractor shall provide and place suitable signs indicating the purpose of each control valve, test connection, main and auxiliary drain, etc., as required.
21. Provide 286 degrees intermediate temperature ENT or stainless steel pendent sprinklers in steam rooms and saunas. Sprinklers shall be Viking Microfast or equal.
22. Provide higher intermediate temperature rated sprinklers in all areas required due to service conditions and as required by NFPA 13.
23. Provide sprinklers at the top floor and on alternating floors below in all linen and trash chutes.
24. Provide sprinkler connections to all required food service hood suppression systems.

2.05 DRY SPRINKLER SYSTEMS

A. The Contractor shall furnish and install all specialty valves, pipe and equipment as required for the systems. The systems shall be complete with dry pipe valve, air compressor, accelerator, maintenance pressure compressor and associated trim

and wired for interconnection to all required accessories, heat/smoke detectors, pressure switches, etc. as required.

B. Pad-mounted storage tank/air compressors assemblies and riser-mounted air compressors shall be sized, furnished and installed as an integral part of the dry pipe sprinkler system and shall meet all requirements of NFPA.

C. Should wet pipe systems in non-heated spaces be substituted for dry sprinkler systems as designed, the contractor is responsible for adding heat tracing, including all required electrical, insulation, supervision, etc. Substitutions or alterations to the original design shall be clearly stated on shop drawing submittals.

2.06 HEAT TRACING CABLE FOR FREEZE PROTECTION OF PIPING

A. Provide pipe insulation with water proof covering and listed electric heat tracing cable on all fire protection standpipe, cross main, feed main and branch piping located within areas exposed to temperatures below 40° F and as indicated on the Contract Documents.

B. Provide a complete UL Listed or FM Approved system of self-regulating heating cables, pipe insulation, controllers and components to maintain exposed fire protection piping at or above 40°F.

C. Electric heat cable shall be installed linearly along the bottom of the pipe and allowance shall be made for all fittings, valves, pipe supports, etc. Cable shall be installed prior to insulation of the piping system.

D. Electric cable shall be capable of maintaining a minimum water temperature of 40 degrees F at an ambient air temperature of 0 degrees F.

E. The electric cable shall be the self-regulating type that responds to varying localized temperature conditions by varying the heat output along its length. This shall be accomplished by a self-regulating core which varies its resistance continuously with changes in temperature. A constant wattage heater is not acceptable.

F. Provide single or multiple circuit digital controller as required by the project, connected to and monitored by the building BAS system. All enclosures shall be NEMA 4X.

G. All heat tracing systems shall be supervised as required by NFPA 13.

H. Provide a thermostat control, which de-energizes the heating cable when the ambient air temperature is above 40 degrees F (adjustable). While energized, the heat cable shall be entirely self-regulating.

I. Provide all power connection hardware, splices, end seals, etc., to accomplish installation. All hardware shall be by the same manufacturer as the cable.

J. Electric heating cable and accessories shall be UL Listed. Electric heating cable shall conform to all requirements of Division 26.

K. Electric heating cable shall be Raychem XL or Engineer approved equal.

L. All piping shall be insulated with 1" thick fiberglass insulation with factory applied all-service jacket. Piping exposed to exterior conditions shall be provided with 0.016" minimum corrugated aluminum metal jacketing with bands on 3'-0" centers.

M. Heating-cable circuit shall be protected by a ground-fault device for equipment protection. This requirement is in accordance with section 427-22 of the NEC-2005.

N. All heating cable components shall be UL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable.

2.07 TESTS AND DRAINS

A. The Contractor shall provide test connections as required and as indicated on the Drawings. Inspector’s test connections shall be fitted with sight glasses and the discharge of the drain riser shall be terminated above an adjacent hub drain with an air gap fitting. All tests shall have approved sight test assemblies as required by NFPA.

2.08 ELECTRIC MOTORS AND RELAYS

A. Design, type and ratings of electric motors shall comply with the National Electrical Code, NEMA and Underwriters Laboratories Inc.

B. Unless otherwise noted, or required for special applications, motors shall be equipped with sealed ball bearings.

C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.

D. Electric motors shall be NEMA Premium Efficiency open drip proof type. Motors shall meet NEMA MG1 Table 12-12 of EISA, 2010. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75 BHP would require a nominal 7½ HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall be capable of operating at ± 10% of the design voltage without voiding the manufacturer's warranty.

E. Motors controlled by a variable frequency drive (VFD) shall be inverter duty motors designed according to the requirements of NEMA MG 1, Part 31, "Definite Purpose, Inverter Fed Motors" and shall be compatible with the particular manufacturer's drive that is used.

1. Shaft Grounding Rings - All motors controlled by variable frequency drives shall be equipped with a maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge damaging shaft voltages away from the bearings to ground.
   a. Motors up to 100HP shall be provided with one shaft grounding ring installed either on the drive end or non-drive end. Motors over 100HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or contractor and shall be installed in accordance with the manufacturer's recommendations.
   b. Shaft grounding rings shall be AEGIS bearing protection ring by Electro Static Technology-ITW.
2. High Frequency Grounding Straps - All motors controlled by variable frequency drives shall be bonded from the motor foot to the system ground with a high frequency ground strap fabricated of flat braided, tinned copper with terminations to accommodate motor foot and system ground connection.
   a. Proper grounding of motor frame for all inverter-driven induction motors shall be in accordance with ABB Technical Guide No.5 and Allen Bradley Publication 1770-4.1 Application Data Industrial Automation Wiring and Grounding Guidelines
   b. High frequency bonding strap shall be AEGIS high frequency ground strap by Electro Static Technology-ITW.

F. All motors to be mounted on equipment supplied under this section shall be as manufactured by General Electric, Westinghouse, or Louis Allis.

2.09 PIPING AND EQUIPMENT IDENTIFICATION

A. A marker showing the service and an arrow indicating the direction of flow shall be applied on the following equipment installed under this section of the Specifications:

1. All above ground fire protection standpipe and sprinkler piping
2. All above ground sprinkler drainage piping

B. Piping identification shall be applied in areas of exposed construction and in areas with accessible or lay-in ceilings. The piping shall be labeled at each valve, wall and floor penetrations (both sides) and at connections to equipment. In addition, straight runs of piping shall be labeled at intervals not greater than 25 feet.

C. Equipment and component parts thereof shall bear manufacturer's nameplate, giving manufacturer's name, size, type model number or serial number, and electrical characteristics, to facilitate maintenance and replacements. Nameplates of distributors or subcontractors are not acceptable. Electrical equipment shall be UL Listed as applicable.

D. The letter size and background color shall conform to the Identification of Pipe System ANSI A-13-1. The vinyl plastic markers shall be as manufactured by Seton Name-Plate Company, W.H. Brady Company, or Westline Products.

E. All valves shall have a 1-1/2" diameter laminate plastic tag, engraved, black and white marking and a brass hook for attaching to valve stem. Tags shall have letters as large as practical, the number of the valve and the service such as indicated on the "Legend." The numbers of service shall be consecutive. Tags shall be similar to Seton 2961.

F. All valves on pumps shall be similar to the valve tags specified above, except they shall be 2-1/2" in diameter, black with white number 2" high for attaching to valve stem by means of brass hook or small solid link brass chain. Tags shall be similar to Seton 2961-25.

G. These numbers shall correspond with numbers indicated for valves and controls on two printed detailed lists and locational diagrams. These printed lists and locational diagrams shall state the numbers and locations of each valve and control and the section which it controls.

H. The printed lists shall be prepared by Wrico pencil lettering or typed and shall be framed under glass, and mounted as directed by the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Drawings are diagrammatic and the final arrangement of the work shall suit field conditions, the characteristics of the materials used and coordination with all other disciplines and the building components and finishes. Verify all dimensions in the field. Access and clearances must be provided and maintained for the proper operation, maintenance service and repair of the work.

B. No sprinklers are to be installed prior to the building being completely sealed in from external moisture and conditions.

C. All standpipe, sprinkler and drain piping exposed to sight in stairwells is to be painted with two coats of an epoxy based paint, color to be selected by the Architect.

D. All equipment and materials shall be installed according to manufacturer's recommendations and shall meet the requirements of NFPA and the Owner's Insurance Underwriter.

E. All sprinklers in spaces visible to public view shall be located symmetrically in relation to ceiling design elements, lighting fixtures, speakers, diffusers, etc. All ceiling components are to be indicated on the submittal drawings as noted previously to ensure coordination with all ceiling elements and devices. Piping to sprinklers in these areas is to be provided with arm-overs or flexible sprinkler drops to allow for exact placement of sprinklers.

F. Sprinklers shall be installed at the centerpoint of all 2' x 2' lay-in ceiling tiles, and at the centerpoint or 1' from the ends of 4' x 2' ceiling tiles.

G. Do not install sprinklers that have been dropped, damaged, show a visible loss of fluid, or a cracked bulb.

H. The sprinkler bulb protector shall be removable by hand, without tools or devices that may damage the bulb.

I. Where pipe is installed above suspended ceilings, it shall be located in the clear space above the suspended ceiling and the pendent sprinklers shall be located to clear the ceiling supporting grid system, the ceiling mounted fixtures, and air conditioning ducts and outlets.

J. The Contractor shall install additional pendent sprinkler heads under all ductwork or other obstructions which are over 48" wide in accordance with NFPA-13 in areas of exposed construction.

K. All sprinklers located in areas that are to be painted shall be protected prior to painting.

L. Provide a pressure gauge at the top level of all standpipes.

M. Where wet fire protection standpipe, cross main, feed main and branch piping are located within areas exposed to temperatures below 40° F, listed electric heat tracing and pipe insulation shall be installed in accordance with the requirements of Section 2.06 – Heat Tracing Cable for Freeze Protection of Piping.

N. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

3.02 PREPARATION

A. Arrangements shall be made to have the openings, inserts, sleeves, blockouts, and such other incidentals set in place ahead of the construction work, where practical, to eliminate the need of cutting and patching. If coring becomes necessary for installation of the work, it shall be done under this section. All holes shall be neatly patched and finished to match the adjoining work in a manner approved by the Architect. All coring shall be performed in a manner not to weaken the structural parts and the manner and method shall be submitted to the Structural Engineer for approval.

3.03 SLEEVES AND ESCUTCHEONS

A. The Contractor shall furnish and set pipe sleeves and inserts for all work under this section and shall be responsible for their proper and permanent location. In the event that failure to do so requires cutting and patching, the remedial work shall be the responsibility of the Contractor.

B. All pipes passing through floors, walls or partitions shall be provided with sleeves having an internal diameter 1-1/2" (3/4" annular space) larger than the outside diameter of the pipe or insulation on covered lines, except as otherwise specified herein.

C. Sleeves for all pipes through walls, beams and partitions shall finish flush with the finish line of the walls, beams and partitions.

D. Sleeves for all piping shall extend 1/2" above finish floor, (except where under partitions, the sleeves shall be flush with the bottom of the partition) and after the

installation of pipe shall be packed and made watertight with fire stopping sealant to maintain separations and fire ratings.

E. Where pipes pass under footings and through exterior walls, sleeves shall be of galvanized steel pipe and shall be not less than 4" larger than the pipe being sleeved. Sleeves shall be made watertight where passing through waterproofed surfaces, exterior wall, and floor slabs on grade. Waterproofing shall be done by means of a steel slip on welding flange, continuously welded at the center of the sleeve and shall be painted with one coat of bitumastic paint inside and outside. The space between sleeve and pipe shall be packed with oakum to within 2" of each face of the wall; (to within 2" of the top of sleeve at floors). The remaining space shall be packed and made watertight with a waterproof mastic. Mechanical expansion type rubber seals such as manufactured by Calpico Ind. and Thunderline Corporation are acceptable as alternate method of water proofing piping penetrations.

F. Sleeves through floors or interior masonry walls shall be of galvanized steel pipe or wrought iron pipe size except where located in concealed pipe spaces where they may be of 22 gauge galvanized sheet steel if fire rating is maintained.

G. Sleeves through interior masonry partitions shall be of 22-gauge galvanized sheet steel.

H. Sleeves for piping to receive insulation shall be large enough to allow continuous insulation through sleeves.

I. Spacing between or location of pipe sleeves in floor slabs, structural beams or structural walls shall be subject to the Structural Engineer’s approval.

J. Where pipes pass under load bearing footings they shall pass through a coated steel pipe sleeve as described above and extend past a 45 degree line out from the bottom of the load bearing structure. Concrete shall be used as backfill in the portions of trench within the 45 degree pressure line.

K. Escutcheons shall be provided around all exposed pipe passing through walls, partitions, ceilings and floors in finished spaces. Escutcheons shall be of sufficient outside diameter to cover the sleeve opening and shall fit snugly around the insulated or bare pipe and to the wall, partition, floor or ceiling.

3.04 WORKMANSHIP

A. All work shall be coordinated with the work to be performed or installed under other sections of these Specifications.

B. All work shall be executed in a workmanlike manner by workmen skilled in this type of work and shall present a neat appearance when completed.

C. Offsets shall be provided as required to avoid interference and conflicts with other work, to maximize headroom, or to improve the appearance of pipe runs. All pipe supports, structural members, hangers and other apparatus necessary to support firmly and substantially the various components of the systems shall be provided under this section.

D. Nameplates, catalog numbers and rating identifications shall be securely attached to equipment with screws or rivets. Adhesives or cements will not be permitted.

E. The subcontractor shall be responsible for the protection of the work from injury and shall protect all apparatus with suitable enclosures.

3.05 ERECTION AND INSTALLATION

A. Installation and workmanship requirements are specified hereinafter.

B. This subcontractor shall be responsible for the furnishing and installing of all support steel, hangers, rods, clamps, etc., to provide adequate support of all Fire Protection equipment specified herein. All support assemblies shall be UL Listed or FM Approved.

3.06 CLEANING OF SYSTEMS AND PREMISES

A. At all times, keep the premises clear of undue accumulation of rubbish.

B. On completion of the work, remove all rubbish and debris resulting from this Contract, and dispose of same.

C. All equipment shall be thoroughly cleaned and left in a satisfactory condition for proper operation at project completion. All equipment shall be partially or fully re-painted as required to provide an appearance of new equipment.

3.07 TESTS

A. Tests of all fire protection systems and equipment, underground and inside piping including alarm and detection devices shall be scheduled with one (1) week prior notification to a local representative of the Underwriter and the Architect. All tests and test procedures shall be in accordance with the applicable NFPA standards. After completion of all tests, the “Contractor’s Materials and Test Certificate” shall be submitted to the Architect.

B. The Contractor shall supply all materials, labor, utilities and power required for testing. Preliminary tests shall be performed to prove work is satisfactory prior to requesting a test inspection. Sectional tests shall be made before insulation or concealing any piping.

C. Repair all defects disclosed by tests or, if required by the Architect, replace defective work with new systems and materials at no additional cost to the Owner. Repairs to piping systems shall be made with new material. No caulking of screwed joints, cracks or holes will be accepted. Make tests in stages to facilitate work of others.

D. The Contractor shall be responsible for the repair and/or replacement cost installed and finishes damaged by leaks, tests and/or repair and replacement of his work at no additional expense to the Owner.

E. Prior to final acceptance by the Owner, submit the "Contractor's Material and Test Certificates" indicating system compliance with all applicable sections of NFPA.

3.08 SUBCONTRACTOR'S WARRANTY

A. The Contractor shall warrant all equipment and the installation to function properly for a period of one year from date of final acceptance of the work.

B. Defects becoming apparent within the warranty period shall be repaired by the Contractor. In addition, all damages to installed work and finishes resulting from such defects shall be the responsibility of this Contractor either to repair or replace to equal the existing installation.

C. This warranty shall in no way obligate the Contractor to repair any and all damages resulting from accident or improper operation or care on the part of the Owner.

END OF SECTION

SECTION 22 00 00

PLUMBING GENERAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Engineer shall be notified of the discrepancy.

D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of the following sections:

1. Section 22 00 00 - Plumbing General
2. Section 23 00 00 - HVAC General
3. Section 26 00 00 - Electrical General

1.02 STANDARDS

A. All Plumbing systems shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides.

1. The International Plumbing Code, 2012 Edition, with most current State of Georgia Amendments
2. The International Building Code, 2012 Edition, with most current State of Georgia Amendments
3. The International Gas Code, 2012 Edition, with most current State of Georgia Amendments
4. International Energy Conservation Code, 2009 Edition, with most current State of Georgia Amendments

5. Americans with Disabilities Act (ADA)
6. ANSI/NSF 61 compliance is required for all components of the domestic water system.
7. American Society of Plumbing Engineers (ASPE) Data Books
8. National Fire Protection Association (NFPA) Standards:
9. NFPA 54 - National Fuel Gas Code
10. Plumbing Drainage Institute (PDI)
11. Underwriters Laboratories Inc. (UL)
12. National Sanitation Foundation (NSF)
13. Local and State Fire Marshal requirements
14. Local Building and Inspection Department requirements
15. Local Health Department requirements
16. ASHRAE 90.1-2010

B. If code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.03 PERMITS

A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.04 WORK INCLUDED

A. Systems

1. The Plumbing Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to, the following as noted below. The connection point for all systems from the site utilities shall be as 5'-0" from the exterior of the building unless specifically otherwise noted.
   a. Domestic cold, hot and hot water recirculation systems
   b. Sanitary, drainage, waste and vent systems
   c. Natural gas/propane gas system
   d. Primary and emergency storm drainage systems

1.05 DRAWINGS

A. The Drawings are diagrammatic and do not necessarily depict exact conditions. The indicated locations of equipment, ductwork, piping, etc. are approximate only. The Drawings are schematic in nature and are not to be scaled. Scales are shown for

reference and approximation only. Refer to the architectural drawings for dimensional data of building components.

B. The locations, arrangement and extent of equipment, devices, and other appurtenances related to the installation of work shown on the Drawings are approximate. The Contractor shall not scale drawings but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy for resolution.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.06 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review, describing installation, operation and maintenance of all Plumbing equipment. Manuals shall include copies of control schematics, sequences of operations, indicate the function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data, parts lists and instructions manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in a 3-ring binder(s).

B. The Contractor shall give detailed instructions for a period of not less than two (2) days to the responsible personnel designated by the Owner in the operation and maintenance of all equipment furnished under this Contract. A letter containing the name of the person or persons to whom the instructions were given and the dates of instruction period shall be submitted to the Engineer in the as-built submittal.

C. Prior to final acceptance by the Owner, the Contractor shall submit a complete as-built drawing submittal for the Engineer's review, three (3) sets of operating and maintenance manuals, spare parts lists, drawings, wiring diagrams, troubleshooting data, manufacturer's bulletins, and other pertinent data on all equipment furnished under this Contract. Each set shall be enclosed in a suitable hard cover binder.

D. A complete set of reproducible as-built drawings shall be provided indicating the location of all piping dimensionally located from a minimum of two column lines or major building structures. Drawings shall be a minimum of 1/8" scale.

E. Provide name, address and telephone numbers of the manufacturer's representative and service company for each piece of equipment installed in the as-built submittal package.

F. Provide all loose keys for supply valves, wall hydrants and hose bibbs installed.

G. Provide a full repair kit set (total relief valve kit, first check and second check kits) for each reduced pressure backflow preventer installed.

1.07 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes to indicate actual final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of 1/8" scale.

B. The original set of "as-built" drawings shall be scanned and transmitted to the Architect in both full size mylar and CD format.

1.08 EQUIPMENT, MATERIAL BID BASIS

A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in Specifications or on Drawings as "base" products. Proposed alternate equipment and materials may be submitted along with the "base" products, provided deductive pricing is included with the alternate.

C. Alternate "approved equal" items listed shall conform to specified base items and shall be substantially equal in quality, size, weight, construction, capacities and performance. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. The Engineer shall consider the use of the alternate equipment based on the supportive documentation and other information available to him and shall approve or disapprove any alternates. The decision of the Engineer shall in all cases be final.

D. The Contractor shall coordinate the installation of all plumbing equipment proposed for use in this project with all building trades (architectural, structural, mechanical and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions

required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.09 START-UP-SERVICE

A. The service of a factory-trained representative shall be provided on the jobsite for a minimum of one (1) day to provide the manufacturer's certification and start-up of all major equipment and systems including booster pumps, water heaters, sewage ejectors, lift stations, fuel oil systems, etc. A formal report is to be issued indicating any revisions required for certification of the assembly by the manufacturer. Instruction and training of the operator's personnel shall be provided following certification of the assembly.

1.10 SUBMITTALS

A. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' submittals on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted electronically (e.g. pdfs, etc.) with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review. Submittals, as a minimum, shall include:

1. Plumbing fixtures, faucets and trim
2. Water heaters and storage tanks
3. Domestic water pressure booster system
4. Insulation
5. Floor drains and drainage accessories
6. Hydrants and hose bibbs
7. Mixing valves
8. Submersible pumps
9. Hot water return pumps
10. Backflow preventers
11. Grease/oil interceptors
12. Pipe and fittings
13. Valves
14. Pipe supports
15. Piping accessories
16. Pipe labels and valve tags

B. All approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to equipment being submitted to the Engineer.

C. Review of submittals by the Engineer does not relieve the Contractor from the responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements of all approved equipment with other trades and disciplines such as roof openings, wall openings, electrical characteristics, etc.

D. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

E. Submittals shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc. of the proposed equipment. Any proposed deviations from specified equipment shall be clearly indicated on the submittal.

F. Included with submittals of plumbing equipment requiring electrical connections shall be a written statement confirming coordination of voltage requirements, bearing the names and signatures of the plumbing and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the electrical contractor.

Plumbing Contractor:_____

Project Manager Name:_____

Project Manager Signature/Date:_____

Electrical Contractor:_____

Project Manager Name:_____

Project Manager Signature/Date:_____

G. Provide Material Safety Data Sheet (MSDS) or letter from manufacturer certifying the VOC content for each adhesive, sealant, paint and coating.

H. VOC Content: Submit adhesive and sealants product information or MSDS showing VOC Content information for all applicable products specified under this section. All applicable products in this section must meet low VOC content as specified by LEED Specification Section 01 81 13 Sustainable Design Requirements.

1.11 COORDINATION OF TRADES

A. The Contractor shall give full cooperation to other trades and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

B. Piping and other plumbing equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated piping and other plumbing equipment installed should they interfere with the proper installation and mounting of electrical, HVAC equipment, ceilings and other architectural or structural finishes.

C. The Contractor shall coordinate the elevations of all piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.

D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.

E. The Contractor shall confirm that work installed under this section does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.

F. Work that is installed under this Contract which interferes with the architectural design or building structure, shall be removed and relocated as required at no additional cost to the Contract.

G. All offsets, fittings, valves, devices and accessories which may be required are to be provided under this Contract. The Contractor shall examine the entire set of Contract Documents and carefully investigate the structural and finish conditions affecting all his work and shall arrange such work accordingly for the complete satisfactory operation of all systems, providing such fittings, traps, valves, devices and accessories as may be required to meet such conditions.

1.12 WARRANTY

A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.

B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Contract Documents shall be suitable for the intended use and shall be subject to approval by the Engineer.

B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.

C. All equipment shall bear the inspection label of Underwriters Laboratories Inc.

D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

E. Cast iron soil pipe and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute.

2.02 ELECTRICAL WORK

A. Except as otherwise specified or noted, electrical equipment used for plumbing systems shall be as specified herein.

B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the Contractor compatible with the apparatus that it operates. Electrical equipment shall be wired for the voltage, as shown on the Electrical Drawings.

C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.

D. Electric motors shall be NEMA Premium Efficiency open drip proof type. Motors shall meet NEMA MG1 Table 12-12 of EISA, 2010. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75 BHP would require a nominal 7½ HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall be capable of operating at ± 10% of the design voltage without voiding the manufacturer's warranty.

E. Motors controlled by a variable frequency drive (VFD) shall be inverter duty motors designed according to the requirements of NEMA MG 1, Part 31,

"Definite Purpose, Inverter Fed Motors" and shall be compatible with the particular manufacturer's drive that is used.

1. Shaft Grounding Rings - All motors controlled by variable frequency drives shall be equipped with a maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge damaging shaft voltages away from the bearings to ground.
   a. Motors up to 100HP shall be provided with one shaft grounding ring installed either on the drive end or non-drive end. Motors over 100HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or contractor and shall be installed in accordance with the manufacturer's recommendations.
   b. Shaft grounding rings shall be AEGIS bearing protection ring by Electro Static Technology-ITW.
2. High Frequency Grounding Straps - All motors controlled by variable frequency drives shall be bonded from the motor foot to the system ground with a high frequency ground strap fabricated of flat braided, tinned copper with terminations to accommodate motor foot and system ground connection.
   a. Proper grounding of motor frame for all inverter-driven induction motors shall be in accordance with ABB Technical Guide No.5 and Allen Bradley Publication 1770-4.1 Application Data Industrial Automation Wiring and Grounding Guidelines
   b. High frequency bonding strap shall be AEGIS high frequency ground strap by Electro Static Technology-ITW.

F. Starters for motors 1/3 HP and smaller shall be manual type, and for 1/2 HP and larger, shall be magnetic type. Starters shall be minimum size 0, combination type (with disconnect and lockable handle) with molded case circuit breaker. Starters for motors with remote or automatic control shall be magnetic. Relays, interlocks and auxiliary contacts shall be provided as specified and required.

G. Magnetic motor starters shall be across-the-line, full voltage, non-reversing type unless otherwise indicated on the Drawings or specified herein.

H. Motor controls shall be either "Hand-Off-Auto" switches or "On-Off" push buttons with one indicating light. "Hand-Off-Auto" switches shall be provided for automatically controlled apparatus.

I. Motor starters that are not an integral part of equipment shall be installed in conformance with Division 26 - Electrical Requirements.

J. All "loose" disconnects and starters shall be installed by Division 26.

K. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 26. All equipment requiring electrical power shall be provided with a disconnect switch at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer's recommendations and the electrical drawings.

L. Provide all system controls and associated control and interlock wiring for complete and operable systems. 120 volt and higher wiring shall be MC cable or in conduit in accordance with local codes and the materials and installation requirements of Division 26 - Electrical.

M. All starters for 3-phase equipment shall have overload devices in each phase.

N. Wiring diagrams shall be furnished by the Contractor.

O. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.03 PIPING SYSTEMS

A. General

1. The various piping systems are classified as follows, and materials of construction shall be as specified unless otherwise noted on the Drawings.
2. Piping, valves and equipment used in similar applications shall be provided from the same manufacturer unless noted otherwise.

B. Domestic Cold-Water System, Underground, 3 Inches and Larger, Suitable for Working Pressure of 125 psig to 5'-0" Outside Building

1. Piping Systems
   a. Basis of Design
      1) Ductile iron thickness Class 51 for 3 inch and 4 inch size thickness, Class 50 for 6 inches and larger, ANSI A21.51, ASTM A746 with bituminous coating outside and cement mortar lining inside. Ductile iron mechanical or push-on joints and fittings ANSI/AWWA C110/A21.10.
   b. Deductive Alternates
      1) Mains where pressure is no greater than 100 psi: Polyvinyl Chloride (PVC), 160 psi water piping, ASTM D2241, SDR26 with mechanical or push-on joints with neoprene "O" rings, ASTM D3139.
      2) Mains where pressure is greater than 100 psi: Polyvinyl chloride (PVC), 200 psi water piping, AWWA C900, 200

psi, with mechanical or push-on joints with neoprene "O" rings, ASTM D3139.

2. All valves, fittings, and changes in direction or elevation shall have joints restrained in accordance with NFPA-24.
3. Trenching Conditions: Class B1 bedding with 4" minimum thickness of clean granular fill. Recesses shall be provided at all pipe barrels to ensure no loads are transmitted at the joint connections.

C. Domestic Water System Branch Piping, Underground, 2 Inches and Smaller, Suitable for a Working Pressure of 125 psig

1. Piping Systems
   a. Copper Type K, soft annealed, conforming to Federal Specification WWT-799. Joints and fittings are not permitted below floor slabs with copper Type K soft annealed pipe.
   b. Multi-layer CPVC over aluminum composite middle layer bendable piping, ASTM D2846, solvent cement joints and fittings, ASTM F493. Noveon FlowGuard Gold Bendable.

D. Domestic Cold Water and Hot Water Systems Above Ground

1. Piping Systems
   a. Basis of Design
      1) Polypropylene piping, Aquatherm Green pipe SDR 7.4 for cold & hot water systems 3" and smaller, or SDR 11 for hot water systems 4" and larger and all cold-water systems based on the required minimum pressure rating and use temperature, see chart below. Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Provide pipe wrap or insulation for piping in all plenum applications that meet the requirements of ASTM E84. When piping will be exposed to UV light for more than 30 days a factory UV protection must be provided per the manufacturer's recommendations. Fittings/Joints: Shall be aquatherm green pipe electro-fusion welded PP-R joints and fittings, ASTM F2389, NSF 61certified.

Temperature	**Pipe Sizes**	**SDR 7.4 Green Pipe Permissible working pressure (psi)**	**SDR 11 Green Pipe Permissible working pressure (psi)**
50	(All pipe sizes)	415	220
80	(All pipe sizes)	340	180
100	(All pipe sizes)	255	135
120	(All pipe sizes)	213	112
140	(All pipe sizes)	180	93

Temperature	Pipe Sizes	SDR 7.4 Green Pipe Permissible working pressure (psi)	SDR 11 Green Pipe Permissible working pressure (psi)
160	(All pipe sizes)	120	-
180	(All pipe sizes)	100	-

b. Deductive Alternates

1) Hot and Cold-Water Systems: Chlorinated Polyvinyl Chloride (CPVC) Schedule 40, ASTM F-441 and D-2846 (100 psi at 180 degrees F). Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Schedule 40 socket type CPVC, ASTM F-439 and F-441. Joints: Solvent cement and primer for CPVC piping, ASTM F-493. All metal thread connections to fixtures and fittings (tub spout, showerhead, etc.) shall be connected with a brass transition fitting.

Temperature		SDR 11 FlowGuard Gold CPVC Permissible working pressure (psi)	Schedule 80 Corzan (for Pipe Sizes greater 2") Permissible working pressure (psi)				
	Pipe Sizes	**½"-2" (max size)**	**2½"**	**3"**	**4"**	**6"**	**8"**
73-80		400	420	370	320	280	250
100		325	344	303	262	229	205
120		260	273	240	208	182	162
140		200	210	185	160	140	125
160		160	168	148	128	112	100
180		100 (max. temp)	105	92	80	70	62
200			84 (max. temp)	74	64	56	50

2) Hot and Cold-Water Systems within Living Units: Cross-linked polyethylene (PEX) plastic tubing, PEX-a grade, ASTM F-876; ASTM F-877 (100 psi at 180 degrees F). Brass, copper or engineered plastic (EP) fittings, ASTM F-1960. Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings/Joints: Cold expansion fitting with PEX reinforcing rings, ASTM F-1960 or cold expansion fitting with metal compression sleeve, ASTM 2080.

a) Acceptable PEX manufacturers/systems:

(1) Uponor Wirsbro Aquapex tubing with ProPEX fittings
(2) Rehau PEX tubing and fittings

b) All PEX tubing and fittings shall be from the same manufacturer.

c) Galvanized pipe and nipples are not acceptable for any portions of the domestic water system.

Temperature	**Pipe Sizes**	**SDR 9 PEX piping Permissible working pressure (psi)**
73-80	3/8"-4"	160
120	3/8"-4"	130
180	3/8"-4"	100
200 (max temp)	3/8"-4"	80

E. Sanitary, Waste and Vent and Storm Drain Systems, Below Ground to 5'-0" Outside Building

1. Piping Systems
   a. Basis of Design
      1) Schedule 40 DWV PVC pipe, ASTM D1785. Install per ASTM D2321. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM D2665. Joints: Solvent joints for PVC, ASTM D2564. (PVC piping is not acceptable for waste piping receiving discharge higher than 130 degrees F, cast iron piping is to be installed at the central plant, mechanical rooms and at all laundry and kitchen equipment discharges.)
   b. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
   c. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
   d. Foam core PVC piping is not acceptable for any drainage system.
   e. All cast iron pipe and fittings shall carry an NSF International listing.

F. Sanitary, Waste and Vent Systems and Storm Drainage Systems Above Ground

1. Piping Systems
   a. Basis of Design
      1) Polyvinyl Chloride (PVC), schedule 40 DWV PVC pipe, ASTM D1785. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM D2665. Joints: Solvent joints for PVC, ASTM D2564. PVC piping is not acceptable in plenum

ceilings or for waste piping receiving waste discharge higher than 130 degrees F, such as from laundry and kitchen equipment.

b. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.

c. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.

d. Foam core PVC piping is not acceptable for any drainage system.

e. All cast iron pipe and fittings shall carry an NSF International listing.

G. ProSet Fittings

1. Cast in place fire penetration sleeves such as ProSet and Holdrite Hydro Flame may be installed in lieu of block-outs and/or steel sleeves only in areas where the design ceiling clearances are maintained.

2. Code Red stack assemblies manufactured by ProSet Systems are not an acceptable fire stopping method for any system.

H. Pumped Discharge Piping

1. Piping Systems

a. Type “L” hard drawn copper tubing per ASTM B-88 and Federal Specification WWT-799. Fittings: Grooved end, solder or brazed joint copper fittings per B16.18 or 16.22. Victaulic Installation-Ready Style 607H (300 psi).

b. Hot and Cold-Water Systems: Chlorinated Polyvinyl Chloride (CPVC) Schedule 40, ASTM F-441 and D-2846 (100 psi at 180 degrees F). Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Schedule 40 socket type CPVC, ASTM F-439 and F-441. Joints: Solvent cement and primer for CPVC piping, ASTM F-493.

2.04 VALVES, FLANGES AND UNIONS

A. General

1. All systems under this section shall be provided with valves to permit complete and sectional control of the system. They shall be located to permit easy operation, replacement and repair. They shall be installed where shown on the Drawings, or as herein specified. Valves shall be as manufactured by one of the following companies: American, Anvil International, Conbraco, FNW, Kennedy, Kitz, Milwaukee, Nibco, Powell, Stockham, Victaulic, Watts, or approved equal, and shall conform to description listed below.

2. Control valves shall be provided for the domestic hot and cold-water supply to all risers and specific areas such as restrooms, fixture groups, equipment, hose bibbs and wall hydrants, food service areas and building separations. Valves shall be located in back-of-house or service areas with access panels or above lay-in ceilings. Access panels will be permitted in public spaces with gypsum ceilings. The tower riser control valves will be provided with an access panel concealed below the lowest guestroom vanity or above the ceiling in the closet in the lowest level unless specifically noted otherwise.

B. Valve Description

1. Gate Valves
   a. 2-1/2" and larger, Stockham G-634, 175 lb. flanged OS&Y.
   b. 2" and smaller, Milwaukee Fig. UP149, 125 lb., sweat connection. 2-1/2" and larger, Milwaukee Fig. F-2885, 125 lb., flanged or Milwaukee CW 223 Butterfly valve with 10 pos. lever handle.
   c. 8" and larger, Milwaukee CW 323 Butterfly valve with gear operator.
   d. 2-1/2" and smaller, Milwaukee No. BB-SC100, threaded.
2. Check Valves
   a. 2" and smaller, Milwaukee Fig. UP509, 200 lb., threaded.
   b. 2-1/2" and larger, Milwaukee Fig. F-2974, 125 lb. flanged.
   c. 2-1/2" and larger, Stockham G-939, 175 lb. flange.
3. Ball Valves
   a. 2" and smaller, Milwaukee UPBA 100.
4. Plug Valves (Natural/Propane Gas System)
   a. 1/2" and larger, Rockwell Nordstrom Fig. 142 or 143 lubricated plug valve, threaded or flanged as required, wrench operated.
   b. 1/2" through 2", two-piece full port brass ball valve, FM and AGA approved, Watts series FBV-3 or equal.
5. Balancing Valves (Hot Water Recirculation)
   a. Balancing valves shall be venturi orifice type, bronze or brass body with brass or chrome ball, a minimum of two differential pressure read-out ports, 300 psi minimum working pressure. A compatible positive shutoff ball valve with memory stop is to be provided if not included with the balancing valve assembly.
   b. Balancing valves shall be Flow Design Incorporated (FDI) model AC or MC or approved equal by ITT or Bell and Gossett.
   c. Ball valves are not acceptable for balancing the hot water return system.
   d. Circuit solver balancing valves with integral ball valves hall be allowed in all recirculation systems.
6. Backflow Preventers
   a. Backflow preventers shall be installed at all locations required by code and local authorities, at all connections to mechanical equipment, and elsewhere as shown on the Drawings. Backflow

preventers shall be reduced pressure principle type and shall be a complete assembly including tight-closing shutoff valves before and after the device. The design shall include test cocks and a pressure-differential relief seating check valves. The device shall meet the requirements of and be certified by ASSE Standard 1013, AWWA Standard C-506, and USC Foundation for Cross-Connection Control. A strainer shall be located upstream of the device. Route relief outlet from cone receptor to an air gap fitting for discharge to sanitary sewer. Backflow preventers mounted in the vertical orientation shall be listed and approved for vertical installation.

b. Acceptable manufacturers are Ames Company, Apollo Valves, Hersey Products, Watts Regulator, and Zurn-Wilkins.

7. Class II turbine type water meters shall be installed downstream of the backflow preventer, on the domestic water supply to HVAC equipment make-up, irrigation supply, and pool/fountain supply to allow for a reduction in sewer rate charges.

8. Pressure Reducing Valves
   a. A pressure reducing valve shall be provided on all domestic water systems greater than 80 psi.

9. Flanges
   a. All flanges shall be faced and drilled for not less than 125 pounds steam working pressure complete with necessary adapter and shall be of size and material of adjacent piping. All flanges shall be faced (raised or flat) to be compatible with connecting valves, equipment, etc. The connection of one raised face flange to a flat face flange shall not be permitted.

10. Unions and Joints
    a. Unions on drainage pipes on fixture side of traps may be slip or flanged joints with soft rubber washers or gaskets. Unions 2" and smaller on copper pipe shall be all brass with ground joint and shall be 250# copper to copper. Unions above 2" shall be flanged with gaskets. Provide union at water and gas connection to all equipment, except plumbing fixtures.
    b. Bathtub waste and overflow joints shall be soldered if required by local authorities to eliminate the requirement for an access panel to bathtub drain connection.

2.05 REMOTE READ WATER METERS

A. A remote read water sub-meter shall be provided for each dwelling unit.

1. Basis of Design

The domestic water sub-metering system shall be H2O Degree provided by ION Energy Solutions. The meter shall comply with all H2O Degree requirements, including, but not limited to:

a. Hourly or daily water meter readings should be sent from the water meters in individual apartments with the use of the wireless sub-metering system
b. Wireless communication shall occur between a transmitter/receiver, less than 24 cu. in., connected to a water meter and the Aqura Cloud gateway. The gateway and a coordinator should be "Plug and Play" with no configuration required.
c. The coordinator should interface with the Aqura Cloud gateway using a USB 2.0 cable
d. The data from the gateway should be retrievable automatically via an Internet connection.
e. The system must utilize **bi-directional wireless communication** technology (i.e. radio frequency based) and should use Direct Sequence Spread Spectrum (DSSS) in conjunction with the Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) technique.
f. The wireless smart-metering equipment should support multiple billing companies (often called Read, Bill and Collect - RBC)

2.06 CLEANOUTS

A. Cleanouts shall be provided where indicated on Drawings and elsewhere as required by code.

1. Cleanouts in pipelines shall consist of Schedule 40 PVC DWV cleanout plug with square head as scheduled on the Drawings. Where piping is concealed in floors or walls cleanouts shall be installed in or near surface of floor or walls and have countersunk plugs with covers.

B. Cleanouts shall be provided at the base of the stack on all sanitary, waste and drainage stacks. Base of stack cleanouts on piping located within walls or partitions shall be cast iron cleanout tee with countersunk plug and chromium-plated round access cover, J.R. Smith figure 4530 or approved equal.

C. Base of stack cleanouts on hotel, condominium student housing, multi-family projects, etc. shall have the stack located behind the water closet at the lowest level to allow for concealing the base of stack cleanout behind the tank of the water closet.

D. Brass cleanouts shall be solid nut construction.

E. Provide Owner with three (3) wrenches for removing flush cleanout plugs.

2.07 FLOOR DRAINS

A. Setting Grades

1. The plumbing contractor shall obtain exact elevation of finished grade at the top of the drains prior to setting any drains. Drains installed in excess of 1/4" below the adjacent finished floor shall be removed and reset to the correct elevation.

B. Drain Types

1. All floor drain outlets shall be of size noted on the Drawings. All drains shall be equal to the assembly specified. Acceptable manufacturers are as follows: Josam Co., Zurn Co., J.R. Smith Co., Wade, or approved equal. Drains shall be acid-resisting where indicated.
2. Floor drains noted as FD "DD" for use in deck drainage applications shall be Jay R. Smith Figure 1412-HP, C.I. drain with 13" square heel proof grate, D.I. undergrate with nickel bronze strainer.
3. Floor drains noted as FD "G" for use in public spaces such as Restrooms, Locker Rooms, Showers, etc., shall be general purpose type. Drains shall be cast iron with 6" square nickel bronze strainer and trap primer connection. Drains shall be Jay R. Smith Figure 2005B-L-B6-P050 or approved equal.
4. Floor drains noted as FD "M" for use in mechanical rooms shall be heavy duty type. Drains shall be cast iron shallow type, 12" diameter with ductile iron tractor grate, sediment bucket, and trap primer connection. Secured funnels shall be provided on all drains receiving condensate discharge to eliminate overflow or spillage. Drains shall be Jay R. Smith Figure 2141 series or approved equal. Drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.
5. Floor drains noted as FD "P" for use in planter drains with standpipes shall be Jay R. Smith Figure 2685, C.I. drain with bronze standpipe and dome, field-verify exact height required.
6. Floor drains noted as FD "PD" for use in parking deck drainage areas shall be Jay R. Smith Figure 2142-M, C.I. drain with 11-½" ductile iron grate sediment bucket.
7. Floor drains noted as FD "TD" for use at trench drains in parking deck areas shall be Zurn flow-thru system, Z-812 Series, 12" wide, 4" outlets, Z-812-HPD ductile iron heel proof grate.
8. Green roof planter drains labeled "GR" shall be cast iron body with flashing clamp, perforated stainless steel extension, gravel stop and rough bronze dome. Coordinate the required extension height with the Architect prior to ordering. The entire drain is to be wrapped with filter fabric to minimize blockages. Jay R. Smith 1017-RBD.
9. Green roof planter emergency drains labeled "GRE" shall be cast iron body with flashing clamp, PVC standpipe, gravel stop and rough bronze dome. Coordinate the required standpipe height with the Architect prior to ordering. The entire drain is to be wrapped with filter fabric to minimize blockages. Jay R. Smith 1070-RBD.

10. Floor or hub drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.
11. Unless otherwise noted, acceptable manufacturers shall be Josam, Jay R. Smith, Mifab, Watts, and Zurn.

C. Trap Primers

1. Drains not receiving a continuous discharge are to be provided with an automatic trap primer.
2. Trap primers shall be in-line type actuated by flow independent of pressure, pressure activated primers are not acceptable. Josam models 88250 and 88300.
3. Proset Trap Guards or equal can be used in lieu of trap primers where approved by local authorities having jurisdiction.

D. Roof Drains

1. Roof drains labeled “RD” installed in poured concrete slab shall have a cast iron body with combined flashing and gravel stop, cast-iron dome. Jay R. Smith 1010 or approved equal.
2. Roof drains labeled “RD” installed in steel construction or built-up roof shall have a cast iron body with combined flashing and gravel stop, underdeck clamp and sump receiver, adjustable extension and cast-iron dome. Jay R. Smith 1015-R-C or approved equal.
3. Emergency roof drains labeled “ERD” shall have a cast iron body, combined flashing and gravel stop, cast-iron dome, 3" minimum PVC standpipe under dome, under deck clamp, sump receiver and extension as required. Jay R. Smith 1070-C-R or approved equal.
4. Roof drains labeled RD “S” for use at scupper drains shall be Jay R. Smith Figure 1520T-NB cast iron flush drain with nickel bronze strainer.
5. Unless otherwise noted, acceptable manufacturers shall be Josam, Sioux Chief, J.R. Smith, Mifab, Watts, and Zurn.

2.08 ACCESS PANELS

A. Group valves together above suspended ceilings, walls, furred spaces to minimize the number of access panels, but with all valves freely accessible for maintenance. Locate all valves within 1'-0" of access point.

B. Furnish access panels of proper size to service concealed valves and cleanouts. Panels shall be of the proper type for material in which they occur and are to be furnished by the Contractor but installed by the particular trade for the material within which the access panel is installed.

C. Panels shall have flush doors with No.14 USCG steel door and trim No. 16 USCG steel frame, metal wings for keying into construction, concealed hinges, and

screwdriver operated stainless steel cam lock. Panels shall be shop coated with one coat of zinc chromate primer. Valves above removable ceilings shall have tile clips by the Contractor for identification.

2.09 INSULATION

A. The following shall be insulated:

1. All piping subject to freezing.
2. All hot water and hot water return piping.
3. All horizontal storm drain piping and roof drain bodies.
4. All sanitary traps exposed to areas subject to freezing, refer to "Heat Cable for Freeze Protection of Piping" under Part 2 of Section 22 00 00 for additional requirements.

B. Domestic hot, cold, hot water recirculation, primary storm drainage, and waste drainage piping shall be insulated with black-pigmented, longitudinally pre-slit tubular pipe insulation with closure system consisting of pressure sensitive adhesive and protective release tape applied at the factory. Allows precision-cut angles and pre-cut pieces to be joined by the application of industry standard contact adhesives. Outdoor installation shall require jacketing. All joints and seams shall be sealed vapor tight. All seams and staples shall then be covered with "All Service Jacket" three-inch wide tape.

C. All interior horizontal storm drainage piping systems and roof drain bodies are to be insulated with blanket type glass fiber bonded with thermosetting resin with white vinyl vapor retarding facing, 2" wide stapling/taping tab. Pipe (tubular) insulation must display the ASTM E84 (25/50) flame spread and smoke developed ratings. Any material submitted claiming to be a similar, like, or equal must demonstrate (meet or exceed) the same physical characteristics as Nomaco Insulation manufactured insulation (i.e., pre-slit/pre-glued products, non-porous, and non-fibrous). In addition, materials must meet the following criteria:

1. Material shall have a density ranging from 1.5 to 1.8 lb/ft^3 (ASTM D1622).
2. Material must have a maximum thermal conductivity (k) of 0.25 Btu-in/hr-ft2-°F @ 75°F mean temperature (ASTM C518, ASTM C177 or ASTM C335).
3. Material must have a maximum Water Vapor Transmission rate of 0.00 Perm-in (ASTM E96, Desiccant Method).
4. Material up to 1" thick, when tested in accordance with ASTM E84, shall have a flame spread rating not greater than 25 and a smoke developed rating not greater than 50.

D. Materials as specified in this section shall be manufactured by Thermacell, Kflex, CertainTeed, Johns Manville, Knauf, Owens Corning or equal. Insulation thicknesses shall be as shown in the following table:

Minimum Pipe Insulation			Insulation Thickness for Pipe Sizes				
Piping System Types	Fluid Temperature Range		1 in. and Less	1-1/4 to 2 in.	2-1/2 to 4 in.	5 and 6 in.	8 in. and Larger
	°C	°F	In.	In.	In.	In.	In.
PLUMBING							
Domestic Water	Ambient	Ambient	0.5	1.0	1.0	1.0	--
Domestic Hot Water and Hot Water Recirculation	43-71	110-160	1.0	1.0	1.5	1.5	--
Above Grade Drains and Piping Receiving Condensate or Ice Machine Discharge	4.5-15.5	40-60	0.5	1.0	1.0	1.5	--
Horizontal Storm Drainage	Ambient	Ambient	--	--	1.0	1.0	1.0

2.10 HEAT TRACE CABLE FOR PROTECTION OF PIPING (FREEZING AND FOG)

A. Provide electric heat tracing on all domestic water piping and sanitary traps exposed to areas subject to freezing.

B. Provide heat tracing on all grease waste piping above and below ground.

C. Provide a complete UL Listed, CSA Certified, or FM Approved system of heating cables, components, and controls to prevent pipes from freezing.

D. Electric heat cable shall be installed linearly along the bottom of the pipe and allowance shall be made for all fittings, valves, pipe supports, etc. Cable shall be installed prior to insulation of the piping system.

E. Electric cable shall be capable of maintaining a minimum water temperature of 40 degrees F at an ambient air temperature of 0 degrees F for freeze protection.

F. Electric cable shall be capable of maintain a minimum water temperature of 110 degrees F for grease waste piping to keep grease from solidifying.

G. The electric cable shall be the self-regulating type that responds to varying localized temperature conditions by varying the heat output along its length. This shall be accomplished by a self-regulating core, which varies its resistance continuously with changes in temperature. A constant wattage heater is unacceptable.

H. Provide a thermostat control, which de-energizes the heating cable when the ambient air temperature is above 40 degrees F (adjustable). The heat cable shall be entirely self-regulating while energized in freeze protection applications.

I. Provide a thermostat control, which de-energizes the heating cable when the grease waste pipe temperature is above 120 degrees F (adjustable). The heat cable shall be entirely self-regulating while energized

J. Provide all power connection hardware, splices, end seals, etc., to accomplish installation. All hardware shall be by the same manufacturer as the cable.

K. Electric heating cable and accessories shall be UL Listed. Electric heating cable shall conform to all requirements of Division 26 - Electrical Requirements.

L. Electric heating cable shall be Raychem XL-Trace or approved equal, 8 watts per foot.

M. All piping shall be insulated with 1" thick fiberglass insulation.

N. Heating-cable circuit shall be protected by a ground-fault device for equipment protection. This requirement is in accordance with section 427-22 of the NEC-2002.

O. All heating cable components shall be UL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable.

2.11 PIPE SUPPORTS AND HANGERS

A. All piping shall be supported by means of hanger rods and pipe hangers from roof or floor structure using supplementary steel and/or lagbolts. Water supply pipe connecting to pumps, equipment, fixtures or fixture supplies shall be made rigid at the connection point.

1. Piping shall be supported from new concrete construction with Anvil International Fig. 282 inserts or drilled expansion anchors.
2. Piping shall be supported from new steel construction with Anvil International Fig. 131 beam clamp, Fig. 61 beam clamp, Fig. 66 welded beam attachment or Fig. 60 washer plate with all-thread rod.
3. Piping and brackets shall be supported from hollow block construction using drilled masonry holes and cadmium plated toggle bolts.
4. Piping shall be supported from wood truss construction with Sioux Chief Pick-Up Talon or equal. Product must be compatible with CPVC.
5. Pipe supports shall not be attached to floor or roof deck.
6. Acceptable manufacturers are: Anvil, Sioux Chief, B-Line and FNW.

B. Unless otherwise noted, hangers and clamps shall be as listed below (all model numbers are B-Line Systems):

1. Insulated water pipe - B3100 or B3109 with B3151 placed over insulation protection saddle.
2. All supports and mounting hardware are to be galvanized, cadmium plated, or factory enamel painted.
3. All supports on insulated piping systems shall be sized to fit outside the insulation and shall be provided with insulation inserts and shields at each hanger or support point.

C. Branch piping to fixtures in chases shall be supported with plastic or copper clamp type supports:

1. B-Line Ruffin series.
2. Holdrite Systems.

D. Maximum spacing between pipe hangers shall be:

1. PVC/CPVC and all plastic pipe:
   a. 1-1/4" and smaller: 3'-0"
   b. 1-1/2" and larger: 4'-0"

E. At least one hanger shall occur within 2'-0" from where change in direction takes place. Where pipes extend down or up to other floors, pipe clamps shall be provided on each floor to support vertical risers. Vertical piping drops shall be rigidly anchored to structure at the top and bottom offsets and at eight-foot increments along the vertical drop.

F. Special approved hangers that require less installation space are to be used where required due to ceiling space limitations.

G. All connections to pumps and other vibrating machinery shall be provided with stainless steel braided flexible hose connections. Connections to potable water systems shall meet ANSI/NSF 61 design standards.

2.12 EXPANSION FITTINGS AND LOOPS

A. All vertical DWV piping stacks in buildings shall have expansion fittings to allow for building shrinkage compensation. The fitting shall be equal to IPEX piston style expansion joint HxH 21381-AWBC series. Expansion fitting shall be documented specifically for shrinkage of building materials and thermal expansion/contraction.

1. Wood framed buildings shall have a fitting in the first-floor ceiling space and every other floor thereafter.
2. Concrete buildings shall have a fitting in the first-floor ceiling space and every 8 floors thereafter.
3. All buildings stacks shall utilize riser pipe clamps at each floor.

B. All water piping shall have expansion loops installed in the system for thermal expansion and contraction. Expansion/contraction shall be compensated for using Z-bends, U-bends, expansion joints, and/or flexible connectors. Installation size and location shall be dependent on piping system material used. Refer to manufacturer installation instructions and expansion detail on drawings.

2.13 WATER HEATERS – ELECTRIC

A. Provide electric storage type water heaters as specified on the Drawings.

B. Water heater shall carry a UL certification for 150 psi working pressure, an ASME temperature and pressure relief valve (T and P) sized for the heater, vacuum relief valve, immersion thermostat, glass lined tank, temperature gauge on outlet, and manual reset high limit control.

C. Provide a metal drain pan at each water heater. Water heaters greater than 10 gallons shall be floor mounted.

D. Provide a combination ball/relief valve on the domestic water supply sized as indicated on the Drawings, Watts series BRV or approved equal.

E. The water heater shall carry a five-year minimum limited warranty for tank leakage.

F. Electric water heaters shall be as manufactured by:

1. A.O. Smith
2. Bradford White
3. Lochinvar
4. State

2.14 FLASHING

A. Vent pipes passing through roof shall be flashed watertight.

B. The roof connections shall meet the approval of the manufacturer of the roofing materials and shall comply with the roof bond requirements.

C. All vent piping shall be offset above ceilings or in attic space and as shown on the Drawings to penetrate roofs on the least visible sides of building.

2.15 FLOOR, WALL AND CEILING PLATES

A. Furnish and install heavy gauge chromium plated steel wall and ceiling plates on all exposed pipes in finished areas where they pass through walls, ceilings, etc. Plates shall be of type that will remain permanently in position and where pipes are insulated they shall be of size necessary to cover insulated pipe.

2.16 GALVANIC PROTECTION

A. Connections between dissimilar metal water pipe shall be made with dielectric unions or flange waterways so there will be no contact between the metals or with insulating bushings. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

B. Insulate joints between dissimilar metals with suitable isolation gasket and bolts with fiber ferrules and washers and/or suitable armored insulation fittings by Clearflow, Crane, Capital, Mifab, or Epco,

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.

B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such times and in such a manner as to avoid damage and as required by the job progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.

C. The Engineer reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.

D. Mounting heights, unless otherwise noted, are to the finished bottom of the device.

E. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.02 EXCAVATION, TRENCHING AND BACKFILLING

A. The Contractor shall perform all excavation to install the work herein specified and as indicated on the Drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and others excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. No tunneling or boring shall be done except under pavement.

B. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, and tamped in 12" layers. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.

C. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and tamped until the crown of the pipe is covered by a minimum of 6" of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned. In instances where the manufacturer's installation instructions for materials are more restrictive than those prescribed by the code, the material shall be installed in accordance with the more restrictive requirement. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 95% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off. A metallic lined underground warning tape shall be provided 12" below finished grade. The tape shall be identified as to the type of line per ANSI standard nomenclature and color.

D. Provide a layer of sand at least 6" deep under all plastic pipe installed in soil. Bell holes shall be excavated to ensure that the sewer pipe rests for its entire length upon a solid trench bottom.

E. Perform excavation and backfilling work in accordance with applicable portions of the earthwork section.

3.03 STORAGE AND PROTECTION OF MATERIALS

A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.

B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until final connection to system is made.

C. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

D. Handle and store materials in accordance with manufacturer's and supplier's recommendations and in manner to prevent damage to materials during storage and handling. Replace damaged materials.

E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.04 CUTTING AND PATCHING

A. Work shall include all cutting, patching, masonry and carpentry required as part of the equipment installation when not provided by other sections of these specifications.

B. All work shall be performed as specified under architectural specification section for cutting and patching.

3.05 CONCRETE WORK

A. Construct curbs, pads, vaults and similar supports for equipment where required.

B. Provide 3" thick housekeeping pads at floor mounted equipment a minimum of 3" larger than the entire area occupied by equipment. Dowel pads to structural slab.

C. Perform concrete work in accordance with applicable portions of Concrete sections. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

3.06 CLEANING

A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.

B. After all equipment has been installed, but prior to start-up, all equipment, piping, etc. shall be thoroughly cleaned both inside and out.

C. After startup of systems as specified and just prior to Owner review and acceptance, all systems shall be finally cleaned and shall be left ready for use.

3.07 PAINTING

A. Painting, except as otherwise specified, will be done under another section of the specifications, but the Contractor shall leave all surfaces of work free of rust, dirt and grease.

B. The Contractor shall touch-up to match original finish any equipment scratched in shipment or installation. Touch-up painting of plumbing equipment shall be part of the plumbing work.

C. Provide one coat of rust preventive primer on all new structural steel supports and new ferrous surfaces which are not galvanized (this includes piping systems). Rust preventative painting shall be part of the plumbing work.

D. All painting and coating shall match the original and shall conform to the requirements detailed in other sections of these specifications. Do not paint over nameplates on equipment, nonferrous hardware, accessories or trim.

3.08 EQUIPMENT SUPPORT

A. Major equipment supports (framed structural openings, etc.) shall be furnished and installed by others as shown on the Drawings. The plumbing work shall include, the furnishings and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all equipment.

B. Unless otherwise shown on the Drawings, all equipment, piping, and accessories shall be installed level, square, and plumb.

C. All equipment, piping, etc. supported by structural joists shall be supported by the top chord only of such joists. Hangers shall not be attached to the bottom chord of any joists.

3.09 PIPE PENETRATIONS

A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe penetrations. Sleeves for pipe shall be Schedule 40 black steel. Sleeves shall be sized to provide a minimum of 1/4" clearance between the sleeve and pipe.

B. The 1/4" minimum clearance shall be provided between the sleeve and the insulation on insulated piping systems. A gap of the insulation shall be omitted at each side of a rated wall penetration to allow for the required fire stopping.

C. As far as possible, all pipe penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.

D. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.

E. Pipe penetrations through exterior walls shall be sealed watertight with expandable link type seals by Thunderline, Linkseal or Engineer approved equal.

F. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be fire-stopped as required to retain the integrity of the UL rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, or approved equal.

3.10 FLASHING

A. All piping penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in other sections of these specifications.

B. Flashing for piping shall have a base not less than 2 square feet, and shall extend up over and into the open end of the pipe. All flashing shall be properly caulked and sealed.

3.11 PIPING SYSTEMS

A. Water Piping - General

1. Pipe used in piping assembly must be clean of dirt and obstructions and shall have ends square and reamed before putting into the fittings.
2. All piping must be true and plumb.
3. All domestic water lines serving flush valve fixtures and washing machines shall be protected from water hammer by shock absorbers. Where shock absorbers are required they shall be as manufactured by Josam Mfg. Company, J. R. Smith, Sioux Chief Ind., Precision Plumbing or Zurn Mfg. Co. and shall conform to the Plumbing and Drainage Institute published requirements.
4. All connections to water heaters, tanks and equipment shall be made with unions or flanges. Insulated piping systems shall be installed to provide space for insulation.

B. Sanitary Waste, Vent, Indirect Waste and Storm Drain Piping - General

1. Pipes shall be plumb and parallel to building walls, beams and columns unless otherwise indicated. All horizontal lines are to be evenly pitched and properly secured with iron or steel hangers, unless noted otherwise. A pitch of 1/8 inch per lineal foot shall be maintained on all soil, and waste lines, wherever possible.
2. All soil and waste pipes shall be extended out full size through the roof or connected to a common vent as shown on the Drawings.
3. Main vent stacks shall run parallel to the soil pipe stacks and shall connect to the vent continuation of the soil stack at least three (3) feet above the rim of the highest plumbing fixtures on the stack. Vent stacks shall also be connected at the base or horizontal offset of the soil stack through a Y and 1/8 bend or an upright Y fittings. Offsets in vent pipe shall be made with 45-degree fittings wherever possible. Horizontal vent lines shall pitch toward the waste line.
4. Threaded joints shall have American National taper screw thread with graphite and oil compound applied to the male threads.
5. Sanitary and vent stacks are to be run straight and plumb and all offsets shall be made at an angle of not less than 45 degrees.

C. Mounting heights, unless otherwise noted, are to the centerline of the equipment and/or device.

3.12 TESTING OF PIPING SYSTEMS

A. General

1. All piping systems shall be subjected, before being insulated or concealed, to testing with water or air as noted and shall hold tight at the pressure head stated for the time interval required without adding air or water. While any system is being tested required head or pressure shall be maintained until all joints are inspected.
2. All tests shall be witnessed by the inspector having jurisdiction and the Owner's Representative, with a minimum 48-hour notice given these authorities.
3. All equipment, material, labor and testing mediums required for testing any of the various systems or any part thereof shall be furnished by the Contractor.
4. All connected equipment, accessories, etc. shall be isolated from piping systems prior to testing.

B. Sanitary Piping Systems

1. Water test shall be applied to these drainage systems either in their entirety or in sections as required, after rough piping has been installed. If the system is tested in sections, each opening shall be tightly closed except the highest opening in the section under test. All sections shall be tested with a

minimum of 10 feet of head. In testing successive sections, at least the upper 10 feet of the next section shall be tested so that no joint of piping in the building shall be submitted to a test of less than 10 feet of head. The water shall be kept in the system for at least 30 minutes before inspection starts; the system shall then be made tight at all points.

2. Any points of the drainage systems to be tested with air instead of water shall be made by attaching an air compressor testing apparatus to any suitable opening and after closing all other inlets or outlets, forcing air into the system until there is a minimum gauge pressure of 5 psi. This pressure shall be held without the introduction of additional air for a period of at least 30 minutes.
3. Exterior connections shall be tested as part of the interior systems.

C. Interior Water Piping Systems

1. Upon completion of the entire water supply system or a section of it as required, it shall be tested prior to connection of fixtures and proved tight under a water/air pressure of 150 psi. Pressure shall hold for a period of one hour without introducing additional water/air. Water used for testing shall be from a potable source of supply. Defective joints or piping shall be replaced as required and all piping shall be retested.

D. Exterior Water Piping System

1. All exterior domestic water piping shall be tested to 150 psi for a period of two hours.

E. Defective Work

1. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. All repairs to piping shall be made with new material. Caulking of screwed joints or holes is not acceptable.

F. Additional Tests

1. Provide all additional tests such as smoke or pressure tests as required by the regulations or as directed by authorities making the inspection.
2. Provide for any repeated test as directed by the Owner's Representative, to make all systems tight as required.
3. Visual inspections of joints, valves, etc. shall be made as directed by the Engineer.

3.13 DISINFECTION OF WATER SYSTEM – INTERIOR AND EXTERIOR

A. Prior to project completion, all potable water piping systems shall be disinfected per local code requirements.

B. Whenever the authority having jurisdiction does not specify disinfection procedures, the new water piping system shall be thoroughly disinfected with a solution containing not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hydrochloride solution and shall be introduced into the system and drawn to all points in the system. The disinfection solution shall be allowed to remain in the system for a period of eight hours, during which period all valves and faucets shall be opened and closed several times. After disinfection, the solution shall be flushed from the system with clear water until the residual chlorine content is not greater than 0.2 parts per million.

C. This work is to be supervised or performed by an approved chemical testing laboratory and results sent to Engineer or his representative for verification.

3.14 FIXTURE CONNECTIONS AND SUPPORTS

A. Wall fixtures shall be hung by means of carrier type fixture supports as manufactured by J.R. Smith, Josam, Mifab, Wade or Zurn.

3.15 SLEEVES

A. Furnish and install pipe sleeves around all piping passing through masonry walls, floors, beams, etc. Sleeves shall be of such diameter as to allow pipe to pass through easily and permit expansion and contraction of pipe. Where pipes are insulated, the sleeves shall be of such diameter as to allow the insulated pipe to pass through easily. The sleeves shall be placed before the pouring of concrete and before construction of walls. Sleeves for vertical risers shall extend a minimum of 1" above the floor slab. Sleeves to outside walls below grade shall be caulked or provided with expansion type mechanical seals as required to make them waterproof.

3.16 INSTALLATION OF UNIONS

A. Unions shall be located as shown on plans and as required by equipment so piping and equipment can be easily dismantled. Unions shall not be installed in any location where they are not readily accessible.

3.17 TRAPS

A. All fixtures, drains, etc. shall be provided with traps, unless specifically shown or specified otherwise. Traps shall be set in an upright position, level and true, and shall be vented as shown and required. All exposed traps shall be provided with cleanout plugs.

3.18 CLEANOUT INSTALLATION

A. Furnish and install cleanouts in soil and waste lines as required by Code and/or job conditions, as shown on the Drawings and as follows: At or near the end of each branch and main drainage line, horizontal lines at intervals as required by code. All cleanouts shall be readily accessible, with plugs easily removable for cleanout lines. Cleanouts at the base of vertical piping shall be held within 2'-0" from finished floor unless otherwise indicated.

3.19 FLASHING INSTALLATION

A. All pipes passing through roofs shall be flashed in an approved manner. Flashing shall be watertight.

B. Roof connections shall meet the approval of the manufacturer of roofing material and shall comply with roof bond requirements.

3.20 EQUIPMENT AND MATERIAL PROTECTION

A. During construction all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers.

B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until connection to system is made.

3.21 SPACE REQUIREMENTS

A. Piping, apparatus and equipment shall fit into the space provided in the building or within the property and shall be installed at such time and in such manner as to avoid damage to the building structure or property as required by the job progress. Equipment, apparatus and accessories requiring normal servicing or maintenance shall be made easily accessible.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 22 00 00 - Plumbing General.

1.02 WORK INCLUDED

A. Receipt, unloading, handling, proper storage and protection from damage of all materials.

B. Layout and coordination of work with other trades.

C. The work under this section shall include all labor, materials, accessories, services, and equipment necessary to furnish and install the plumbing fixtures, trim and supports, complete as indicated on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.01 GENERAL

A. All fixtures shall be white, unless otherwise indicated.

B. All water closets shall have fully glazed trapways.

C. All exposed trim to be heavy polished chrome plated brass, unless otherwise indicated. Chrome plated escutcheons are to be provided on all exposed fixture and food service equipment supplies and waste lines.

D. Electric water coolers shall be ARI Certified and shall carry a UL Listing. Units shall use refrigerant which is approved for use without ozone depleting properties. All waterway components are to be certified as lead free.

E. All sinks and lavatories for use by the disabled shall have manufactured insulation shields on all supplies and P-traps per ADA requirements unless the vanities are provided with ADA compliant shrouds.

F. All exposed plumbing fixture items such as faucets and flush valves shall be provided with vandalproof trim.

2.02 CLEANOUTS

A. Cleanouts on exposed piping in unfinished areas shall be heavy duty cast iron with countersunk plug. Cleanouts shall be Jay R. Smith Figure 4220 or approved equal.

B. Cleanouts installed behind walls in finished areas shall be cast iron ferrule type for no-hub or service weight pipe with nickel bronze round frame and cover with securing screws. Cleanouts shall be Jay R. Smith Figure 4472T or approved equal.

C. Cleanouts installed in concrete floors shall be cast iron type with gasket seal ABS plug round adjustable ductile iron cover with securing screw and Speedi-Set outlet connection. Cleanouts shall be Jay R. Smith Figure 4231L-M or approved equal.

D. Cleanouts installed in tile floors shall be cast iron type with gasket seal ABS plug for easy removal, adjustable round nickel bronze top recessed for tile with securing screw and Speedi-Set outlet connection. Cleanouts shall be Jay R. Smith Figure 4151L or approved equal.

E. Cleanouts installed in carpeted areas shall be cast iron type with gasket seal ABS plug, nickel bronze round frame and cover with carpet marker. Cleanouts shall be Jay R. Smith 4031-Y or approved equal.

2.03 PLUMBING FIXTURES

A. The following is a list of acceptable manufacturers for the project:

1. Fixtures: American Standard, Kohler, Toto
2. Faucets: American Standard, Chicago Faucets, Kohler, Moen, Speakman, Symmons and Zurn
3. Stainless Steel Sinks: Elkay, Just, Kohler
4. Trim: American Standard, Brasscraft, Kohler, McGuire and Zurn
5. Drains, Carriers and Hydrants: Josam, Mifab, Prier, Jay R. Smith, Wade and Zurn

B. Plumbing fixtures shall be as scheduled on drawings:

PART 3 - EXECUTION

3.01 INSTALLATION

A. All wall hung fixtures shall be supported on concealed chair carriers furnished complete with all necessary bolts, nuts, washers and gaskets unless noted

otherwise. The adjustable nipple between the cast iron fitting and the closet bowl shall be threaded cast iron. Secure all floor pieces to floor slab.

B. All exposed piping in connection with fixtures shall be chromium plated. Where supply and waste lines pass through walls, provide chromium plated escutcheons and firmly secure in place.

C. Provide straight or angle supply valves on inlet supplies to all fixtures.

D. Fixtures, trim and methods of piping and installation shall conform to local plumbing code. All fixture types shall be the product of one manufacturer. All fixtures shall be white unless otherwise noted.

E. Bathtub waste and overflow fittings shall be provided with soldered metal connections or PVC solvent welded connections if required by code authorities to eliminate the requirement for access to the fitting.

F. Fixtures shall be cleaned, adjusted and left in proper working order before the project is turned over to the Owner. Flush and clean all faucet aerators prior to turn over. Adjust all faucet lever handles to be parallel to adjacent rear wall in the off position.

G. The Contractor shall furnish and install protective guards as required to protect fixtures against damage by normal operations of other trades. Bathtubs shall be provided with tub liners at all times during construction.

H. Caulk all floor and counter top mounted fixtures and behind all wall-hung plumbing fixtures with white, non-shrinking, silicone caulking eliminating all voids and cracks.

I. Coordinate the mounting height of all fixtures with the Architect prior to installation.

J. The Contractor shall obtain exact information relative to finish grade of the top of the floor drains. All floor drains shall be set flush with finished floors.

K. Cleanouts shall be provided where indicated on drawings and elsewhere as required by code.

L. Where test tees are installed at the base of the stack or on the stack, they may be used as a cleanout.

M. Provide the Owner with three (3) wrenches for removing flush cleanout plugs.

END OF SECTION

SECTION 23 00 00

HVAC GENERAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Refer to Division 1 - General Requirements and any and all Supplementary or Special Requirements, all of which apply to work described in Division 23 - HVAC as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test and leave in safe and proper operating condition all HVAC systems. All HVAC work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawings and Specifications, the higher implied cost shall be included in the bid, and the Architect shall be notified of the discrepancy in writing.

1.02 CODES AND STANDARDS

A. All HVAC work shall conform to all ordinances and regulations of the City, County and State where the work will take place, including the requirements of all authorities having jurisdiction. The following codes, standards and references shall be observed as a minimum:

1. The 2012 International Codes
2. Georgia State Amendments to the Code
3. National Fire Protection Association (NFPA) Standards and Guidelines
4. Local and State Fire Marshal requirements
5. Local Building and Inspection Department requirements
6. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
    a. Standard 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings
    b. Standard 62.1-2010 – Ventilation for Acceptable Indoor Air Quality
    c. Standard 55-2010 – Thermal Environmental Conditions for Human Occupancy

d. Other Standards and Guidelines as applicable

7. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Manuals
8. Underwriters Laboratories Inc. (UL)
9. Americans with Disabilities Act (ADA)

B. If Code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.03 MISCELLANEOUS DEFINITIONS

A. Terms: The following definitions of terms supplement those of the Division 01-General Requirements and are applicable to Division 23 – Heating, Ventilation, and Air Conditioning (HVAC):

1. Contractor: As used herein the term shall mean "the person or entity referred to throughout the Contract Documents as if singular in number. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative."
2. Furnish: As used herein shall mean "supply and deliver to Project site, unload and inspect for damage."
3. Install: As used herein the term shall mean "to place in position for service, temporarily store, unpack, assemble, erect, apply, place, protect, clean, start up, and make ready for use."
4. Owner: As used herein the term shall mean "the person or entity identified as such and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative."
5. Product: As used herein shall include materials, systems, and/or equipment, machinery, components, and fixtures forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
6. Provide: As used herein shall mean "furnish and install, complete and ready for the intended use."
7. The Work: As used herein the term shall mean "the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the

Contractor's obligations. The Work may constitute the whole or a part of the Project.

8. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 WORK INCLUDED

The HVAC Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to:

A. Airside Systems

1. Equipment: including fans, unitary air conditioners, air handling units, fan-coil units, split systems, etc.
2. Ductwork and Accessories: including sheet metal, duct-board, flexible ductwork, fire and smoke dampers, access doors, etc.
3. Air Distribution Devices: including louvers, registers, grilles, diffusers, etc.

B. Refrigerant Systems

1. Piping, Tubing and Accessories: including pipe, refrigerant tubing, valves, solenoids, thermal expansion valves, strainers, air vents, pipe and equipment drains, condensate drains, expansion devices, etc.

C. Equipment, Ductwork and Piping Supports

1. Equipment Mounts: including roof curbs, equipment rails, miscellaneous steel, etc.
2. Hangers and Support Devices: including inserts, hanger rods, strut channel, cross-bracing, anchor bolts, pipe anchors, restraints, etc.
3. Vibration Isolation: including flexible couplings, expansion devices, ssprings, waffle pads, etc.

D. Insulation

1. Ductwork Insulation: including exterior duct wrap, internal duct liner, fire wrap, etc.
2. Piping and Equipment Insulation: including preformed, board and wrap.

E. Miscellaneous HVAC Equipment: Unit heaters, wall heaters, roof hoods, heat tracing, etc.

F. Automatic Temperature Controls

1. Decentralized: including all thermostats, control dampers, line and low-voltage wiring, smoke detectors, etc.

G. Labor and Equipment: including project management, supervision, tradesmen, lifts, fork-trucks, cranes, scaffolding, saws, wrenches, etc.

H. Demonstration and Owner Training

1.05 ENGINEER'S DRAWINGS

A. The locations, arrangement and extent of equipment, devices, ductwork, piping, and other appurtenances related to the installation of the HVAC work shown on the Drawings are approximate and define the intent of the design. The Contractor shall not scale Engineer's Drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy.

B. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.06 EQUIPMENT, MATERIALS AND BID BASIS

A. Manufacturers' names, model numbers, etc. cited on the Drawings and in the Specifications are for the purpose of describing type, capacity, function and quality of equipment and materials required. All project design and coordination between disciplines has been performed as if the named manufacturer and specific piece of equipment will be provided to the project by the Contractor.

B. Alternate equipment and/or materials other than that named on the Drawings and in the Specifications may be proposed for use, but all equipment and materials shall conform entirely to the specified base items. Proposed alternate equipment shall be substantially equal in size, weight, construction and capacity. Alternate equipment and materials shall be submitted only as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. Requests for prior approval of alternate products shall be made at least ten (10) days prior to the bid date and as required by Division 1 - General Requirements. The Engineer shall consider the use of the alternate equipment based on the supportive documentation made available to him, and

shall approve or disapprove any proposed alternates. The decision of the Engineer shall, in all cases, be final.

C. The Contractor shall coordinate the installation of all HVAC equipment proposed for use in this project with all building trades (architectural, structural, electrical, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the equipment submittals for approval. When the Contractor requests substitution of alternate equipment, it is with the knowledge that he shall be responsible for any and all costs required by the substitution, including necessary engineering and construction revisions in his or any other contract or trade to satisfy the design intent shown on the Plans and described in the Specifications.

D. All materials exposed within HVAC plenums shall have a flame-spread index of not more than 25 and a smoke-developed rating index of not more than 50 unless otherwise allowed by code.

1.07 SUBMITTALS

A. The Contractor shall prepare, submit and obtain Engineer's review of all manufacturers' data on the HVAC equipment and systems prior to ordering, purchasing or installing any equipment or materials. Six (6) hard copies of the complete submittal are required, five of which will be reviewed and returned by the engineer. Electronic submittals (e.g. pdfs, etc.) may be acceptable, if approved by the architect and described in Division 01 - General Requirements. All submittals shall be transmitted simultaneously in hard ring binders (or in a single .zip file), with the associated specification sections cited and the items submitted clearly identified

1. All HVAC items scheduled on the Drawings
2. Equipment arrangement, ductwork and piping drawings. Contractor drawings shall be prepared at a minimum scale of 1/8" = 1'-0". A scale of 1/4" = 1'-0" scale is preferred. Drawings shall be indicative of actual equipment purchased and shall show all offsets, transitions, fittings, dampers, valves, hanger locations, etc. Sections are required in spatially tight areas. The following will guide the Contractor as to minimum drawing detail required:
    a. Clearly indicate top and bottom of duct and pipe elevations. All elevations shall be coordinated as to not conflict with structural, plumbing, electrical and architectural trades.
    b. Indicate all offsets (both vertical and horizontal).
    c. Indicate graphically all duct and pipe joints and their lengths.
    d. Submit duct and pipe-work fabrication schedule indicating duct size range with minimum duct material gauges, pipe schedule being used, duct and pipe connection joint types, section lengths, duct reinforcement type and spacing, etc.
    e. Indicate graphically all ductwork to be fabricated with internal duct liner.

f. Indicate all insulation for ductwork and piping.
g. Indicate all dampers and valves as shown on design documents and called for in the specifications.
h. Indicate all flexible connectors where required by specifications and notes.

3. Flexible ductwork, duct-board, insulation and linings
4. Dampers, louvers, air distribution devices, wall terminations (wall caps), roof terminations (roof caps, hoods, jacks, etc.)
5. Manufacturer's cut sheets of all piping and tubing materials
6. Where split systems are used in a "long line application," submit manufacturer's refrigerant line set routing drawings and engineered calculations supporting installed line lengths and recommended suction and liquid line sizes (deviations in the installed lengths and sizes shall be recorded on the as-built drawings and coordinated with the manufacturer to reconfirm that long line guidelines are being met).
   a. Identify and provide cut sheets of any and all accessories required to make the system complete, functional and reliable.
   b. Any split system with 75 feet of separation between the outdoor unit and the indoor unit requires that the contractor obtain a warranty approval letter from the equipment manufacturer certifying the long line length distances shown on the submitted shop drawings are acceptable.
   c. Refer to the EQUIPMENT INSTALLATION - COMMON REQUIREMENTS paragraph below.
7. Refrigerant type and charge (lbs.) for each item of equipment utilizing refrigerant.
8. AHRI Certificates
9. Valves, thermometers, pressure gauges
10. Thermal expansion/contraction piping system design including complete layout drawings indicating anchor loads, points, and method of structural support.
11. Roof curbs, equipment supports, hanger systems, vibration isolators, seismic restraints

B. All submittal approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to being submitted to the Engineer.

C. Review of submittals by the Engineer does not relieve the Contractor from responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements (roof penetrations, wall penetrations, floor penetrations, curbs, electrical, etc.) of all approved equipment with the other trades and disciplines.

D. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

E. The Contractor shall provide a written statement confirming coordination of voltage requirements for all HVAC equipment requiring an electrical connection. Statement shall bear the names and signatures of the HVAC and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the Electrical Contractor.

HVAC Contractor: _____
Project Manager Name: _____
Project Manager Signature/Date: _____
Electrical Contractor: _____
Project Manager Name: _____
Project Manager Signature/Date: _____

1.08 PERMITS

A. The Contractor shall obtain all permits and inspections required for the installation of the HVAC work and pay all charges incident thereto. He shall deliver copies of all certificates of permit and inspection to the Architect.

1.09 COORDINATION OF TRADES

A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Piping and other HVAC equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated ductwork, piping and other HVAC equipment installed should they interfere with the proper installation and mounting of electrical, plumbing equipment, ceilings and other architectural or structural finishes.

C. The Contractor shall coordinate the elevations of all ductwork, piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.

D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping,

ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.

E. The HVAC Contractor shall confirm that his work does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.

F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.

G. Coordinate power and fire alarm requirements of all combination fire/smoke dampers and smoke dampers with the electrical contractor.

1.10 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review. Manuals shall describe installation, operation and maintenance of all HVAC equipment and shall include copies of control schematics, sequences of operation, function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data, parts lists, and instruction manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in (a) 3-ring binder(s).

1.11 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record of all changes in the work from that shown in the Contract Documents. The record shall be by red-line mark-up on the most current set of Engineer's Drawings kept in the field office. After all work is completed, the Contractor shall prepare a set of "as-built" reproducible drawings of similar type and quality as the Engineer's Drawings. As-built drawings shall accurately depict actual final arrangement of all HVAC items. As-built drawings shall be delivered to the Architect.

1.12 WARRANTY

A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.

B. All reciprocating and scroll air conditioning compressors shall be provided with an extended 5-year parts warranty.

C. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL

A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Engineer's Drawings shall be suitable for the intended use and shall be subject to approval by the Engineer.

B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.

C. All equipment shall bear the inspection Label of Underwriters Laboratories Inc.

D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

2.02 ELECTRICAL WORK

A. Except as otherwise specified or noted, electrical equipment used for HVAC systems shall be as specified herein.

B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the HVAC Contractor compatible with the apparatus that it operates. Electrical equipment shall be wired for the voltage shown on the Electrical Drawings.

C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.

D. Electric motors shall be NEMA Premium Efficiency open drip proof type. Motors shall meet NEMA MG1 Table 12-12 of EISA, 2010. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75 BHP would require a nominal 7½ HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall be capable of operating at ± 10% of the design voltage without voiding the manufacturer's warranty. Motors that

drive equipment that will run continuously shall be IEC 60034-1 continuous duty rated.

E. Starters for motors ⅓ HP and smaller shall be manual type, and for ½ HP and larger, shall be magnetic type. Starters shall be minimum size 0, combination type (with disconnect and lockable handle) with molded case circuit breaker. Starters for motors with remote or automatic control shall be magnetic. Relays, interlocks and auxiliary contacts shall be provided as specified and required.

F. Magnetic motor starters shall be across-the-line, full voltage, non-reversing type unless otherwise indicated on the Drawings or specified herein. Starters for motors 75 HP and greater shall be solid state, reduced voltage type.

G. Motor controls shall be either “Hand-Off-Auto” switches or “On-Off” push buttons with one indicating light. “Hand-Off-Auto” switches shall be provided for automatically controlled apparatus.

H. Motor starters that are not an integral part of HVAC equipment shall be installed in conformance with Division 26 - Electrical Requirements.

I. All “loose” disconnects and starters shall be installed by Division 26.

J. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 26. All equipment requiring electrical power shall be provided with a disconnect switch at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer’s recommendations and the electrical drawings.

K. Provide all system controls and associated control and interlock wiring for complete and operable systems. 120 volt and higher wiring shall be MC cable or in conduit in accordance with local codes and the materials and installation requirements of Division 26 - Electrical.

L. Coordinate power and fire alarm requirements of all combination fire/smoke dampers and smoke dampers with the electrical contractor.

M. All starters shall be labeled on the face of the device with a semi-rigid plastic laminate nameplate with 1" high white letters on a black background securely affixed to the equipment. The label shall indicate equipment served (equipment tag used on the Drawings). Labels shall be furnished and installed by the Contractor.

N. All starters for 3-phase equipment shall have overload devices in each phase.

O. Wiring diagrams shall be furnished by the Contractor.

P. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.03 AIR FILTERS

A. All filters shall be U.L. 900 classified.

B. Filters shall be pleated disposable type (MERV 6 minimum) unless specified otherwise.

C. Install one set of new filters in air handling equipment during construction and install a new set prior to test and balance. Fan powered induction units shall have a temporary roll filter media installed at the plenum air inlet during construction. Remove temporary filter media prior to test and balance. Clean and vacuum all inlets prior to test and balance.

D. Temporary roll filter media shall be provided at the inlets to all air handling equipment operated during construction. Remove temporary filter media prior to test and balance. Clean and vacuum all inlets prior to test and balance.

PART 3 - EXECUTION

3.01 GENERAL

A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.

B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such time and in such a manner as to avoid damage and as required by the job progress. In general, ductwork, piping, equipment, etc. shall be installed tight to structure above. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Shop drawings shall clearly indicate any conflicts with other trades. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.

C. The Engineer reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.

D. Listed mounting heights are to the finished bottom of the device unless otherwise noted.

E. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.02 STORAGE AND PROTECTION OF MATERIALS

A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.

B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, and test plugs until final connection to system is made.

C. All equipment, piping and ductwork shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

D. Handle and store materials in accordance with manufacturer's and supplier's recommendations and in a manner to prevent damage to materials during storage and handling. Replace damaged materials.

E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.03 CUTTING AND PATCHING

A. The work shall include all cutting and patching required as part of the HVAC installation. Refer to Division 1 - General Requirements.

3.04 CONCRETE WORK

A. Construct curbs, pads and similar supports for equipment where required.
B. Provide 4" (min.) thick housekeeping pads for all floor mounted equipment, extending 6" beyond the area occupied by the equipment. Dowel pads to structural slab.

C. Perform concrete work in accordance with applicable portions of Division 3 - Concrete. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

D. Mix and install grout for HVAC equipment base bearing surfaces and anchors. Provide forms as necessary and place grout to completely fill equipment bases.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right-of-way for piping to be installed with the required slope.

E. For roof and attic mounted equipment requiring routine maintenance, allow for an unobstructed path from the roof/attic service entry point to the equipment. The path area shall be a minimum of 6'-0" high by 3'-0" wide.

F. Split system outdoor unit equipment has been shown indicating matched systems of the indoor unit with its associated outdoor unit. While the location of the outdoor units are approximate, the importance of unit locations relative to the refrigerant line set penetration through a wall or roof is critical for the project. Prior to ordering equipment, the contractor shall carefully coordinate the line set routing and requirements with the split system manufacturer to insure installation guidelines, especially for long line applications, are being followed. Refrigerant line sets shall be routed to reduce the system total equivalent length and minimize system capacity losses due to elbows, fittings, valves, etc. After the coordinated routing drawings have been approved and certified by the split system manufacturer, they shall be submitted for review along with the equipment and any required accessories. During installation, the contractor is responsible for keeping as-built refrigerant piping installation drawings noting any deviations to the proposed routing. Deviations that may affect proper system operation or performance shall be reviewed by the manufacturer immediately and corrective action implemented as required.

3.06 EQUIPMENT SUPPORTS

A. Major equipment supports (structural steel frames, framed structural slab and wall openings, etc.) shall be furnished and installed by others; however, the HVAC work shall include furnishing and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all HVAC equipment.

B. Unless otherwise shown on the Drawings, all HVAC equipment, piping, and accessories shall be installed level, square, and plumb.

C. All equipment, piping, etc. supported by structural bar joists shall be supported only by the top chord of the joists. Hangers shall not be attached to the bottom chord of any joists.

3.07 PIPE AND DUCTWORK PENETRATIONS

A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe and ductwork penetrations. Sleeves for pipe shall be schedule 40 black steel pipe. Refer to Section 23 21 13 – Piping and Accessories for additional information. Sleeves for ductwork shall be 20-gauge galvanized steel. Ductwork sleeves shall be sized to provide a minimum of ¼" clearance between the sleeve and duct. For insulated ducts, the clearance shall be between the sleeve and the insulation.

B. As far as possible, all pipe and ductwork penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.

C. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.

D. Ductwork penetrating walls or floors of any material shall be installed with closure plates on both sides of the penetration.

E. Pipe penetrations through exterior walls shall be sealed weather-tight with a factory fabricated mechanical type rubber seal. Refer to Section 23 21 13 – Piping for additional information.

F. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be fire-stopped as required to retain the integrity of the UL-rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, STI or approved equal. Refer to Division 7 - Thermal and Moisture Protection.

3.08 FLASHING

A. All piping and ductwork penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in Division 7 - Thermal and Moisture Protection.

3.09 EQUIPMENT LABELING

A. All HVAC equipment shall be labeled. This shall include all central plant, air handling or air conditioning equipment, air terminals, and other similar and miscellaneous equipment.

B. Labels for air terminals or other devices shall be located for optimum visibility through access panel or removed ceiling tiles.

C. Equipment labeling shall be one of the following, unless noted or specified otherwise:

1. Permanently attached plastic laminated signs with 1" high lettering
2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel

3.10 CLEANING

A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.

B. After all equipment has been installed, but prior to testing and balancing, all equipment, piping, ductwork, etc. shall be thoroughly cleaned both inside and out.

C. All water piping shall be chemically flushed and cleaned prior to circulating water through equipment.

D. After cleaning, filters shall be installed where required and all systems shall be tested and balanced.

E. After testing and balancing and just prior to Owner review and acceptance, all systems shall be finally cleaned and left ready for use.

3.11 PAINTING

A. Painting will be done under Division 9 - Painting except as otherwise noted, but the HVAC Contractor shall leave all surfaces of work free of rust, dirt and grease.

B. The HVAC Contractor shall touch-up any equipment scratched in shipment or during installation to match original finish. Touch-up painting of HVAC equipment shall be part of the HVAC work.

C. Any visible ductwork through grilles, registers and diffusers shall be painted flat black.

D. All painting and coating shall match the original finish and shall conform to the requirements detailed in Division 9 - Finishes.

E. Do not paint over equipment nameplates, nonferrous hardware, accessories or trim.

3.12 PRESSURE TESTING

A. Unless otherwise specified herein, all HVAC piping shall be tested as required by Code to 1½ times the rated system pressure or 100 psig, whichever is greater. Care shall be taken to isolate all equipment not suitable for this test pressure by installing pipe caps or blank flanges at the equipment connections. All valves and fittings shall be tested under pressure.

3.13 PERFORMANCE AND DEMONSTRATION TESTS

A. All testing and demonstration of any and all HVAC systems required for acceptance by any authorities having jurisdiction shall be included as part of the HVAC work. This shall include the furnishing of any and all testing equipment, smoke generation devices, and any other required equipment or accessories, and all necessary labor required to perform any required tests or demonstrations. The Contractor shall coordinate and verify all devices, equipment and sequence of testing and/or events with such authorities having jurisdiction. The Contractor shall perform a minimum of two (2) satisfactory preliminary tests or demonstrations prior to any formal tests and/or demonstrations for any code authorities and shall give a minimum of five (5) days advance notice to the Engineer of any and all preliminary tests and/or demonstrations, indicating the date and time of such tests.

B. For testing and demonstration of smoke control systems, the requirements in paragraph 3.14.A apply. In addition, coordinate with the owner/operator for witnessing of formal testing.

3.14 TRAINING

A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner’s key operating personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all HVAC equipment and systems. After these sessions are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all HVAC equipment and systems.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.

B. The insulation shall be installed in a neat and workmanlike manner by trained personnel regularly engaged in the installation of insulation and approved by the insulation manufacturer. Insulation, adhesives, coverings and coatings shall be applied in strict accordance with its respective manufacturer's recommendations. Installer has been in business for no less than 5 years and has completed at least 10 installations of similar size projects.

C. The contractor shall verify that test and inspection of the work to be insulated have been completed and approved before the insulation is applied.

D. All insulation must meet applicable codes for Flame Spread and Smoke Developed ratings when tested in accordance with ASTM 84 and UL 723.

1.02 WORK INCLUDED

A. The work done under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install all insulation, complete, as indicated on the Drawings and as specified herein.

1.03 QUALITY ASSURANCE

A. Materials shall be the standard products of manufacturers regularly engaged in the production of insulation products. Insulation materials shall be products that have been in use in commercial buildings for at least 2 years prior to bid opening.

B. Surface Burning Characteristics:

1. Insulation shall have a composite insulation, jacket, binders, and adhesive Flame-Spread rating of 25 or less and a Smoke-Developed rating of 50 or less and shall be so listed by UL.
2. Insulation and related materials shall have surface burning characteristics determined by test performed on identical products per ASTM E 84, NFPA 255, and UL 723, mounted and installed as per ASTM E 2231.

3. Adhesives, mastics, tapes, and other accessories shall have the same component ratings.
4. Materials shall be labeled indicating compliance with the above requirements.
5. All testing shall be performed by a testing and inspecting agency acceptable to authorities having jurisdiction. Insulation, jacket materials, adhesives, mastics, tapes and cement material containers shall be labeled with appropriate markings of applicable testing and inspecting agency.

1.04 RELATED WORK

A. Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be protected and sealed with fire-stopping materials as specified in Section 23 00 00 - HVAC General.

B. Adequate provisions shall be made to protect the premises, equipment, and the work of other trades against droppings, adhesives and coatings used in the installation.

C. Where indicated, painting of insulation jackets shall be as specified in Section 09 91 00 - Painting.

D. Refer to Section 23 23 00 Refrigerant Piping for refrigerant piping insulation.

1.05 SUBMITTALS

A. Submit product information for insulation materials to the Architect in accordance with Division 1 and Section 23 00 00 - HVAC General.

B. Submit shop drawings and data to prove complete compliance with these specifications on products and methods of installation. Include materials used, thickness for each application, flame and smoke ratings, thermal conductivity, permeance, density for each product, and jackets (both factory and field applied). Indicate methods of applications.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to purchase. Insulation shall be CFC and HCFC free.

B. Provide insulation that meets or exceed the requirements of ASHRAE 90.1.

C. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state.

2.03 BLANKET TYPE INSULATION (DUCTWRAP)

A. Description:

1. Flexible, limited combustible, blanket type insulation composed of mineral or inorganic glass fibers bonded together with a thermosetting resin, meeting ASTM C 553, Type 1 and ASTM C 1290.
2. Vapor retarder jacket: Provide one of the following types of vapor retarder jackets:
   a. Foil-scrim-kraft (FSK), foil reinforced kraft (FRK), or polypropylene-scrim-kraft (PSK) with a 2" (50mm) (min.) stapling and taping flange on one edge.
   b. Conforming to ASTM C 1136 Type II.
3. Surface Temperature Application Limits: Insulation shall be rated for use on surfaces operating at temperatures up to 250°F.
4. Ratings:

Insulation Type:	**Type 1:**	**Type 2:**
Minimum R-Value, out of package*: hr•ft²•°F/Btu (m²•°C/W) at 75°F (24°C) mean temperature	R-7.4 (1.30)	R-10.3 (1.81)
Minimum R-Value, installed: hr•ft²•°F/Btu (m²•°C/W) at 75°F (24°C) mean temperature	R-6.0 (1.06)	R-8.0 (1.46)
Minimum Density: lb/ft³ (kg/m³)	1.0 (16)	0.75 (12)
Thickness: Inches (mm)	2 (51)	3 (76)
Maximum Labeled K-value at 75°F (24°C) mean temperature: Btu.•in/hr.•ft²•°F (W/m.•°C)	0.27 (0.039)	0.29 (0.042)

*Value may vary by manufacturer; minimum installed value must be met

B. Insulate the following with Type 1 blanket insulation:

1. All galvanized steel ductwork containing heated and/or cooled supply air, except:
   a. Exposed ductwork in finished conditioned spaces.
   b. Ductwork indicated to be internally lined or insulated with external insulation.
2. Concealed surfaces of ceiling diffusers exposed to non-return air plenums.

3. Return air ductwork exposed to attics or non-return air plenums.
4. Relief air ductwork and plenums from the exterior to 18" past the relief air damper assembly.
5. Return air, toilet exhaust, and general exhaust ductwork exhausting conditioned air and routed through interior spaces that are ventilated with outside air or exposed to outside air conditions.
6. Concealed outside air ductwork located within indirectly conditioned spaces (e.g. indoor soffits, furr-downs, vertical chases, etc.).
7. Ductwork and plenums located inside of the building (i.e. located within the exterior boundary or skin of the building thermal envelope) when containing or flowing, makeup air, garage ventilation intake or exhaust air ducts and plenums, when not indicated to be insulated with rigid fiberglass insulation. This applies to ducts and plenums whether exposed or concealed within chases when located on the interior side of the exterior skin of heated or cooled space.

C. Insulate the following with Type 2 blanket insulation:

1. Ductwork and plenums located outside of the exterior boundary or skin of the building thermal envelope when containing or flowing heated and/or cooled air when not indicated to be insulated with rigid fiberglass insulation.
2. Supply air ductwork located in unconditioned attic spaces and in indoor spaces that are ventilated with outside air or exposed to outside air conditions.
3. Concealed surfaces of ceiling diffusers exposed to attics.

D. Subject to compliance with requirements, insulation shall be manufactured by: CertainTeed, Johns Manville, Knauf, Owens Corning, or approved equal.

2.04 DUCT LINER

A. Refer to Section 23 31 00 – Ductwork and Accessories for duct liner requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Shop drawing submittals shall include a complete package of materials and methods intended for use as described in this section.
B. All work shall be in strict accordance with applicable codes, ordinances and the manufacturer's recommendations.

C. All work shall be performed in a professional workmanlike manner and standard trade practice. It shall be smooth in appearance and suitable for finish painting.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.

B. Refrigerant piping shall meet the requirements of the Safety Standard for Refrigeration Systems (ANSI/ASHRAE Standard 15-Latest Edition) and the Code for Pressure Piping (ANSI/ASME Standard B31.5-Latest Edition: Refrigeration Piping and Heat Transfer Components).

C. Piping, valves, accessories and insulation installed indoors shall have a flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.02 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install all refrigerant piping, insulating systems, and accessories, complete, as indicated and specified herein.

B. Without limiting the generality thereof, the work in this section shall include the following items:

1. Direct expansion (DX) system piping (cooling only and heat pump)
2. Variable Refrigerant Flow/Variable Refrigerant Volume (VRF/VRV) system piping
3. Insulating the following systems:
    a. Refrigerant suction (low pressure gas) piping
    b. Refrigerant hot gas (discharge or high-pressure gas) piping.
    c. Refrigerant liquid piping for VRF/VRV and Heat Pump systems.
    d. Refrigerant liquid piping for ductless split systems

1.03 RELATED DOCUMENTS

A. Specification sections:

1. 23 81 26 Split System Air Conditioners
2. 23 81 28 Split System Heat Pumps
3. 23 81 28.13 Ductless Split System Heat Pumps

1.04 RELATED REFERENCES

A. Designation and Safety Classification of Refrigerants (ANSI/ASHRAE Standard 34-Latest Edition).

1.05 QUALITY ASSURANCE

A. Installer Qualification: Only trained and experienced installers skilled in refrigeration pipe installation and brazing of copper tubing shall be used.

B. Piping, valves and accessories shall be manufactured in the United States. Submit Certificate of Manufacture with shop drawings.

1.06 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, valve arrangements and locations, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Piping materials including Certificate of Manufacture

D. Insulation products, adhesives, coatings, etc. including Material Safety Data Sheets

E. Field quality-control test reports

F. Operation and maintenance data

1.07 PRODUCT STORAGE AND HANDLING

A. Store piping, insulation, valves and specialties in a clean and protected area.

B. Piping, tubes, and coils shall be stored with end caps in place to ensure that piping interior and exterior remain clean prior to installation.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING

A. Piping shall be:

1. Type “L” hard drawn seamless copper tube conforming to ASTM B88, or
2. Type “ACR” (Air Conditioning and Refrigeration) service copper tubing conforming to ASTM B280.
   a. Straight Lengths: ASTM B 75, UNS C12200, H55 Temper (Light Drawn), ACR Bending Quality; Cleaned, Eddy Current Tested, and Plugged per ASTM B 280.
   b. Coiled: ASTM B 280, UNS C12200, O60 Temper (Soft Annealed), ACR, cleaned and capped. Coils shall be dehydrated, purged with Nitrogen and tightly capped to insure cleanliness. Piping shall be engineered and constructed to support R-410A to 700 psi @ 250°F.
      1) Acceptable manufacturers:
         a) Streamline/Mueller
         b) Reftekk, Inc.
         c) Linesets, Inc.
         d) ACR Green Proshield by Select Manufacturing, Inc.
         e) JMF Company

B. Joints shall be brazed. Brazing filler metals shall comply with AWS A5.8. Mechanical press type joints are not allowed.

2.02 VALVES, FITTINGS AND SPECIALTIES

A. Fittings shall be wrought copper conforming to ASME/ANSI Standard B16.
B. Valves, filter-driers and other accessories shall be suitable for refrigerant service.

C. Field Swaged Brazing Cups: MSS-SP-73, ASME B 16.50

D. Field Bends (all angles): ASME B31.5

E. Full Port Refrigeration Service Valves:

1. Body: Forged brass uni-body style with brass cap including key end to remove core
2. Schrader service valve with cap
3. Core: Removable ball-type check valve with stainless-steel spring
4. Seat: Polytetrafluoroethylene
5. End Connections: Socket ends
6. Working Pressure Rating: 700 psig (factory tested)
7. Maximum Operating Temperature 300°F
8. Valves must be specifically rated for R-410A

9. Approved manufacturers: Diamondback, Parker, Mueller/Streamline

2.03 INSULATION

A. Refrigerant piping shall be insulated as follows:

1. Operating temperatures up to 220°F: flexible elastomeric tubing insulation (PVC/NBR), AP/Armaflex Black LapSeal™ pipe insulation as manufactured by Armacell, LLC or approved equal. All joints and seams shall be sealed weather-tight with Armaflex Black LapSeal™ Tape. Black LapSeal™ Tape shall also be used to secure the thermostat cable to the pipe insulation prior to applying the finish coat. The finish coat for flexible elastomeric insulation installed outdoors shall be two coats of a water-based latex paint designed for use over all forms of flexible elastomeric insulation. Finish coat shall provide a protective finish suitable to both indoor and outdoor applications, formulated for cold weather flexibility to resist cracking and weather-resistant to ultraviolet (UV) and ozone. Coating shall be Armaflex WB finish or equivalent product compatible with the insulation.
   a. Acceptable alternate products:
      1) Aeroflex, USA, Inc. Aerocell with Protape and two coats of field applied Aerocel Aerocoat.
      2) K-Flex Titan™ (no field applied protective coating required)
3. Operating temperature from 220°F to 257°F: Flexible Elastomeric Foam: EPDM - Closed cell expanded rubber. Comply with ASTM C 534, Type I for tubular materials for refrigeration pipe sizes 1/4" and greater.
   a. Outdoor Use: EPDM pre-split with lap seal and two coats of field applied UV and ozone resistant coating:
      1) Aeroflex, USA, Inc., EPDM Aerocel-SSPT with two coats of field applied Aerocel Aerocoat
      2) Armacell, LLC, EPDM UT SolaFlex, pre-split with lap seal and with two coats of field applied Armaflex WB
      3) K-Flex Titan™ HT (no field applied protective coating required)
   b. Indoor Use: EPDM pre-split with lap seal:
      1) Aeroflex, USA, Inc., EPDM SSPT
      2) Armacell, LLC, EPDM UT SolaFlex, pre-split with lap seal
      3) K-Flex Titan™ HT
   c. Applied to Annealed Coiled Tubing (Line Sets):
      1) EPDM continuous tube
         a) Streamline/Mueller
         b) Reftekk, Inc.
         c) Linesets, Inc.
         d) ACR Green Proshield by Select Manufacturing, Inc.
         e) JMF Company
         f) K-Flex Titan

4. Fittings, valves and specialties shall be insulated with factory formed sectional units of the materials listed above.
5. Insulation that is outdoors and not directly exposed to sunlight (i.e. piping is enclosed in a prefabricated duct system) does not require the UV protective coating.
6. Valves and specialties shall be provided with a factory insulation package fabricated from materials listed above.
7. Insulating systems above are to be considered as a minimum. Air conditioning system manufacturer's recommendations take precedence over the insulation materials listed above.

B. Insulation thickness shall be as follows:

1. VRF/VRV Heat Pump and Heat Recovery Systems - Insulate all piping: (Note that some ductless split systems and multi-split systems may operate at these temperatures. Verify operating temperatures with the manufacturer)

VRF/VRV Refrigerant Piping Systems											
REFRIGERANT CONDITION or PHASE	REFRIGERANT TEMPERATURE RANGE (°F)	INSULATION MEAN RATING TEMPERATURE (°F)	ACR TUBING OUTSIDE DIAMETER								
			1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1-3/8"	1-5/8"
			INSULATION THICKNESS REQUIRED (INCHES)								
HIGH PRESSURE VAPOR	201-250	150	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"
	141-200	125	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	2"
LIQUID	105-140	100	1"	1"	1"	1"	1"	1"	1-1/2"	1-1/2"	1-1/2"
LOW PRESSURE VAPOR	40-60	75	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1"
	BELOW 40	50	1"	1"	1"	1"	1"	1"	1-1/2"	1-1/2"	1-1/2"
NOTE: FOR PIPING SMALLER THAN 1-1/2 INCHES AND LOCATED IN PARTITIONS WITHIN CONDITIONED SPACES, REDUCTION OF THESE THICKNESSES BY 1 INCH SHALL BE PERMITTED, BUT NOT TO THICKNESSES BELOW 1 INCH.											

ASHRAE 90.1-2010, ASHRAE 90.1-2013 & ASHRAE 90.1-2016

2. Traditional Cooling Only Split Systems (TXV located at indoor unit) – Insulate suction piping only:
   a. All pipe sizes 1/2" insulation
3. Traditional Heat Pump Split Systems (TXV located at indoor unit) – Insulate suction piping only:
   a. <1-1/2" pipe 1" insulation
   b. 1-1/2"<4" pipe 1-1/2" insulation
4. Mini-Split Cooling Only (TXV located at outdoor unit) – Insulate all piping – 1" insulation
5. Mini-Split Heat Pump (TXV located at outdoor unit) – Insulate all piping – 1" insulation

PART 3 - EXECUTION

3.01 GENERAL

A. Refrigerant piping shall be supported as shown on the Drawings and as required at intervals not over 8'-0" O.C. and at all turns and offsets. Hangers and pipe clamps shall be copper plated tubing hangers of adequate size to fit around tubing and insulation as required. Saddles shall be used under insulated tubing to protect insulation. Piping routed in excess of 6 (six) lineal feet on the roof shall be supported by B-Line "Dura-Blok" rooftop supports or approved equal.

B. Pressure testing of piping systems shall be in accordance with standard industry practice for the refrigerant used.

C. Refrigerant piping shall be clean and free of outside contaminants at all times. Prior to start-up of any equipment or insulation installation, all piping shall be cleaned, tested, dehydrated and charged as recommended by the refrigerant compressor manufacturer.

1. Procedure: Joints and connections in refrigerant piping shall not be installed in partitions or walls or where inaccessible for testing, inspection and rework. Make provisions to prevent contact of dissimilar metals. During construction, cap all tubing to prevent moisture from entering. Keep in dry location.
2. Leak testing and recharging: Upon completion of installation of air conditioning equipment, test all refrigerant piping, components and accessories, including quick-connect refrigerant connectors for evaporator and condensing unit; test with a halide torch; prove tight by Contractor to assure a leak-tight refrigerant system. If leaks are detected at the time of installation or during warranty period, remove entire refrigerant charge from system, correct leaks, and retest system. After system is found to be leak free, evacuation shall be accomplished by use of a reliable gauge and a vacuum pump capable of pulling vacuum of at least one mm Hg absolute. Accomplish system evacuation in strict accordance with equipment manufacturer's printed instruction. System leak testing, evacuation, dehydration and charging with refrigerant shall comply with standard industry practice and local codes and ordinances.

D. Refrigerant piping shall be run continuously, without joints, where possible. All joints in refrigerant piping shall be made accessible. Joints shall not be permitted in concrete slabs or below grade.

E. Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access.

F. All piping shall be run true to grade and shall be arranged to make the best possible appearance. Except where otherwise required by conditions of

installation, all piping shall be symmetrical and parallel with lines of buildings or structure in which it is installed. All piping shall be run concealed except in mechanical room and where indicated otherwise.

G. All piping and equipment shall be supported and guided. Anchors shall be provided to absorb or transmit thrust and eliminate vibration or pulsation. Hangers or supports shall be provided near each change of direction. Supports shall be so located or shall be of such type as not to unduly restrict the movement of the pipe due to lateral or longitudinal expansion.

3.02 PIPING APPLICATIONS

A. Suction (low pressure gas), Hot Gas (high pressure gas) and Liquid Lines 5/8" OD and Smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Copper, Type ACR, O60 (soft annealed)-temper tubing and field bent fittings with brazed joints.

C. Suction (low pressure gas), Hot Gas (high pressure gas), and Liquid Lines 2-1/8" OD and smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Straight Lengths, Copper, Type ACR Type L, H55 (light drawn)-temper tubing and field bent fittings with brazed joints.

3.03 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves as specified or as required to isolate system components.

3.04 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; route and size piping based on manufacturer's recommended line lengths and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15 (latest version).

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas. Concealed locations shall be free of pipe joints.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Field bend changes in direction.

I. Select system components with pressure rating equal to or greater than maximum allowable working pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Provide jacketed insulation in locations where exposed to mechanical injury.

M. When brazing, remove solenoid-valve coils and sight glasses; also, remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 00 00 HVAC General.

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 00 00 HVAC General.

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 00 00 HVAC General.

R. Provide proper compensation for pipe/tube expansion and contraction per equipment manufacturers recommendations.

3.05 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube".

1. Use Type BcuP-5 (15% Ag, 80% Cu, 5% P), copper-phosphorus alloy pre-formed brazing rings for joining copper swage fittings and copper socket fittings with copper pipe. Do NOT use flux.
2. Use Type Bag-5 (45% Ag), cadmium-free silver alloy for joining copper with bronze or steel. Use manufacturers recommended flux.

B. Field Swaged Brazing Cups: Fabricate brazing cup on one tubing end for each coupling. Only O60 (soft annealed) and H55 (light drawn) may be swaged. Do NOT swage H58 (drawn general purpose). Use swaging tool designed to provide a minimum of 0.0015" brazing gap and a maximum of 0.005" brazing gap. Brazing cup depth for each tube size shall be as follows:

1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1-3/8"	1-5/8"	2-1/8"
0.250"	0.280"	0.310"	0.390"	0.420"	0.460"	0.510"	0.560"	0.600"	0.700"

C. Field Bends: Fabricate field bends with a center-line bend radius greater than or equal to 4 times the nominal OD of the pipe or tube. Tube shall be bent with a tubing bender sized for ACR OD tube sizes and shall not cause cracks or wrinkles in the tube or pipe. Do NOT use a conduit bender for bending ACR copper. The difference between maximum and minimum diameters for pipe bends should not exceed 8% of the nominal outside diameter of the pipe. Only O60 soft annealed-temper and H55 light drawn-temper shall be field bent. Do NOT field bend H58 drawn general purpose-temper copper tube.

D. Brazing and joining procedure:

1. Tube ends shall be cut with a clean sharp tubing cutter.
2. Deburr the I.D. of the cut tube end with a clean deburring tool.
3. Visually inspect the interior of each tube for obstructions and debris before assembly. Protect the joint from contamination before brazing.
4. Method of pre-cleaning: Non-shedding abrasive pads (Scotch Bright) to remove all oxides in the brazing area followed by wiping with a clean lint-free white cloth. Do not groove the surfaces while cleaning.
5. Purge all tubing with oil free nitrogen while brazing and until cool to the touch. Use an oxygen analyzer to verify the absence of oxygen prior to brazing. The oxygen content shall be less than 1% before start of brazing.
6. Use a neutral to slightly reducing flame using oxy/acetylene or oxy/propane.
7. Use the proper torch tip based on tube size as recommended by the torch manufacturer. Use of Turbo-Torch or Rosebud is permitted.
8. Post Brazing Cleaning: Exterior of all completed joints shall be washed with a water-soaked rag or sponge, followed by brushing with a stainless-steel hand wire brush to remove any residue for inspection.

3.06 HANGERS AND SUPPORTS

A. Piping hangers and supports must accommodate expansion and contraction, vibration, dead load of piping and its contents, and seismic-bracing requirements.

B. Install the following pipe attachments or combination thereof:

1. Adjustable steel clevis hangers for individual horizontal runs.
2. Channel strut or angle iron trapeze for multiple horizontal runs
3. Galvanized steel saddle with attachment screw for channel strut applications
4. Rigid high compressive strength foam insulating pipe support at all clamps and support points.
5. Rigid high compressive strength foam pipe support at all riser clamps.
6. Do NOT attach hangers directly to pipe or tube.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. Up to 3/4" OD: Maximum span, 60 inches; minimum rod size, 3/8 inch.
2. Greater than 3/4" thru 1" OD: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. Greater than 1" thru 2-1/8" OD: Maximum span, 96 inches; minimum rod size, 3/8 inch.

D. Support multi-floor vertical runs every 10 feet and at least at each floor with riser clamps.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test as follows or as recommended by the equipment manufacturer’s installation instructions:
    a. Line Test Pressure for Refrigerant R-410A:
        1) Suction (low pressure gas) Lines: 550 psig, or per equipment manufacturers recommendation.
        2) Hot-Gas (high pressure gas) and Liquid Lines: 550 psig, or per equipment manufacturers recommendation.
3. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

a. Fill system with 95/5 nitrogen/hydrogen to the required test pressure.
b. System shall maintain test pressure at the manifold gage throughout duration of test.
c. Test all joints and fittings with hydrogen leak detector, at test pressure.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.08 SYSTEM CHARGING

A. Charge system using the following procedures and per equipment manufacturer's installation instructions.

1. Evacuate (triple evacuation procedure) entire refrigerant system with a vacuum pump to obtain a steady state vacuum of less than 500 micrometers. If vacuum holds for 12 hours, system is ready for charging. Do NOT evacuate the system through a charging manifold. Use only suction rated hoses and core removal tools.
2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
3. Charge system as recommended by equipment manufacturer.

3.09 OWNER REVIEW OF MAINTENANCE REQUIREMENTS

A. Review manufacturer's maintenance instructions with the owner's representative to make them aware of any reoccurring maintenance requirements such as recoating piping insulation, lubricating service valves, etc.

END OF SECTION

SECTION 23 31 00

DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work in this section shall be subject to the provisions of Section 23 00 00 - HVAC General.

B. Furnish and install all material, labor, accessories, etc. shown on the drawings and as specified herein to completely install all ductwork systems.

C. Ductwork systems shall be classified as follows:

1. Static pressure class +2 in. wg - from constant volume air handling unit, and terminal unit to supply diffusers; all return, outside air and exhaust ductwork;

D. Refer to PART 3 – EXECUTION for duct sealing requirements.

E. Ductwork shall be constructed according to the latest edition of SMACNA ductwork construction standards applicable to the type of ductwork, system pressures described above, and the system material construction.

F. Duct sizes shown on the drawings are nominal inside clear.

1.02 SUBMITTALS

A. Product Data:

1. Duct materials:
   a. Fiberglass ductboard
   b. Flexible duct connectors
   c. Flexible ductwork
2. Dampers and accessories
3. Remote damper operators
4. Access doors
5. Flexible duct connectors
6. Duct liner
7. Sealants, mastics, adhesives and coatings

B. For all fire dampers, combination fire and smoke dampers, and smoke dampers, submit UL approved installation instructions for each specific application.

PART 2 - PRODUCTS

2.01 DUCTWORK

A. Ductwork shall be constructed of galvanized steel sheets of the thickness listed in the SMACNA manuals for the pressures referenced above, [or of 1" thick (1½" thick if required by the applicable energy code) resin-bonded fiberglass duct board with fire-resistive foil-scrim-kraft (FSK) vapor retarder on the outside surface and a smooth mat finish on the air-side surface. Fabrication and installation shall conform to SMACNA's Fibrous Glass Duct Construction Standards; latest edition. See below for additional requirements].

B. Single-Wall Rectangular Ducts and Fittings:

1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
2. Transverse Joints: Select joint types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Transverse (Girth) Joints," for static pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   a. Alternate Product: Subject to compliance with requirements, provide Ductmate Industries, Inc.; 25/35/45 Rectangular Flange System or comparable product by one of the following:
      1) Nexus PDQ; a division of Shilco Holdings, Inc.
      2) Ward Industries, Inc; a division of Hart & Cooley, Inc.
      3) Prior Approved Equal
   b. Slide-on Flanges:
      1) Description: Roll-formed, add on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
      2) Material: galvanized steel
      3) Gauge and Shape: For duct constructed using prefabricated systems, refer to the manufacturer's guidelines for sheet gauge, intermediate reinforcement size and spacing, and proper joint reinforcement.
      4) Manufacturers of prefabricated systems must provide duct construction and reinforcement guidelines along with independent testing for leakage, deflection, and seismic performance.
      5) Independent leakage testing must be provided for systems operating at pressures of 10 in. wg (or greater) positive or negative.
      6) Manufacturer's prefabricated systems printed assembly and installation procedures must be adhered to at all times.

7) Manufacturer's procedures must include fastener and cleat spacing along with details for all system variations including break-away and roofing connections.
8) All manufactured system components must be clearly embossed with manufacturer's name or markings. Substitution of manufacturer's system components is not permitted.

c. Formed flanges will be accepted on ductwork 42 inches wide or less and subjected to 2 in. wg static positive pressure or less.
1) Formed on Flanges: Construct as T-25 A/B flanges, of which construction guidelines are given in Figure 2-1 of the 2005 SMACNA "HVAC Duct Constructions Standards, Metal and Flexible." No other construction standards pertaining to formed on flanges will be accepted.
2) Formed on flanges must include the use of corners, securely crimped in place, bolts, cleat, and gasket

3. Longitudinal Seams: Select seam types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Longitudinal Seams – Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."
4. Snap-lock longitudinal duct seams are not allowed in public spaces unless secured with sheet metal fastening screws as recommended by SMACNA.
5. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Single-Wall Round and Flat-Oval Ducts and Fittings

1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Linx Industries
2) McGill AirFlow LLC
3) SEMCO LLC
4) Sheet Metal Connectors, Inc.
5) Spiral Manufacturing Co., Inc.
6) Prior Approved Equal

2. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
3. Transverse Joints: Select joint types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    a. Transverse Joints in Ducts Larger Than 50 Inches in Diameter: Flanged.
        1) Unexposed Duct 3 inches to 30 inches in diameter: Round duct connects with a one-piece interior slip coupling at least two gages heavier than duct wall, beaded at center and fastened to duct with screws. Seal joint with an approved sealant applied continuously around both ends of coupler prior to assembling and after fastening.
        2) All Exposed Duct and Unexposed Duct 30 inches to 72 inches in diameter: Three-piece, gasket flanged-joint consisting of two internal flanges, with integral mastic sealant, and one external closure ring, for connecting the internal flanges and securing the closed cell neoprene gasketing in place.
            a) Basis-of-Design Product: Subject to compliance with requirements, provide Ductmate Industries, Inc.; Spiralmate or similar comparable product by one of the following:
                (1) Prior Approved Equal
        3) Ducts larger than 72 inches in diameter: Use companion angle flanged joints as defined in Figure 3-1 for the 2005 SMACNA Manual "HVAC Duct Construction Standards, Metal and Flexible" Third Edition. Refer to manual for proper sizing and construction details.
        4) Dust Collection Systems and Exposed Duct 3 inches to 14 inches in diameter: Use a one-piece, polyethylene lined gasket connector with integrated bolt for the closure system.
            a) Basis-of-Design Product: Subject to compliance with requirements, provide Ductmate Industries, Inc.; Quicksleeve or comparable product by one of the following:
                (1) Prior Approved Equal
4. Longitudinal Seams: Select seam types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other

provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

5. Tees and Laterals: Select types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Rectangular sheet metal duct elbows shall be smooth radius type without turning vanes or square (or mitered) type with turning vanes. Sharp throat elbows (ASHRAE Fitting No. CR3-2) shall not be permitted. Round sheet metal duct elbows shall be smooth radius type without turning vanes, gored type or mitered type with turning vanes.

E. Unless otherwise indicated, elbows shall have a centerline radius of not less than 1½ times the width of the duct. Where space limitations necessitate use of short radius or square elbows, provide turning vanes.

F. Fiberglass duct board shall be UL 181 listed as a Class 1 Rigid Air Duct with a minimum thermal conductivity of 0.23 at 75°F per ASTM C 518. Thickness shall be as indicated on the drawings or as required by the energy code in effect. Fiberglass duct board shall be Johns Manville Super Duct RC, Knauf Atmosphere Air Duct Board, Owens Corning QuietR Duct Board or Certainteed Ultra*Duct Black Duct Board.

1. Tapes and mastics used to seal fibrous glass ductwork shall be listed and labeled in accordance with UL 181A and shall be marked "181A-P" for pressure-sensitive tape, "181A-M" for mastic or "181A-H" for heat-sensitive tape.

G. Exhaust ductwork shall be galvanized sheet metal (G 90 minimum) constructed to SMACNA standards and shall not be insulated unless noted otherwise.

H. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 FLEXIBLE DUCTWORK

A. Flexible ducts shall be listed and labeled as UL Standard 181 Class 1 air duct. Air connectors are not allowed.

B. Flexible ductwork shall comply with the following:

1. NFPA 90A, “Installation of Air Conditioning and Ventilating Systems”
2. NFPA 90B, “Installation of Warm Air Heating and Air Conditioning Systems”
3. SMACNA's “HVAC Duct Construction Standards - Metal and Flexible” for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated.
4. Air Diffusion Council's “ADC Flexible Air Duct Test Code FD 72-R1”.
5. ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

C. Flexible ductwork shall be installed between main supply ducts and diffusers. Length shall be a maximum of 8'-0" [5'-0"] long, except in residential applications, where the length shall be as indicated.

D. Flexible ductwork shall be Thermaflex M-KE R-6 (R value = 6.0 minimum or as required by local energy code) flexible air duct or approved equal.

E. Flexible ductwork size shall be the same size as the diffuser neck it serves, unless indicated otherwise.

F. **[Commercial]** Take-offs for sheet metal ductwork shall be made using a conical spin-in type fitting with manual balancing damper.

G. **[Residential]** Take-offs for fiberglass ductboard shall be made using a starting collar fitting with crimp and bead (tab type).

H. Flexible duct connections to ceiling diffusers shall be installed without kinks or sags to provide unrestricted airflow. Provide Flex Flow Elbow supports by Thermaflex.

I. Tapes and mastics used to seal metallic and flexible air ducts shall comply with UL 181B and shall be marked “181B-FX” for pressure-sensitive tape or “181B-M” for mastic.

J. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with ul 181b and shall be marked “181B-C”.

2.03 FIRE DAMPERS

A. Fire dampers shall be installed at all locations where ductwork or supply or return air openings penetrate any floor, wall or partition with a fire rating.

B. All fire dampers shall be of the “Dynamic” type as classified in UL Standard 555.

C. Fire dampers shall have a rating compatible with the floor, wall or partition, shall be tested to UL Standard 555 and be labeled for the intended installation (horizontal or vertical).

D. Maximum pressure drop: 0.10 in. wg; provide ductwork transitions as required so as not to exceed maximum pressure drop.

E. Fire Resistance Rating: 1½ hours unless noted otherwise indicated on drawings for 3 hours.

F. Closure device: Each fire damper shall be equipped with a factory installed heat responsive device (fusible link) rated to close the damper when temperature at the damper reaches: 165°F [212°F].

G. Airflow Closure Rating:

1. Dynamic fire dampers shall be selected for the velocity and pressure rating of the intended installation. Refer to the plans and schedules for airflow rates (CFM) and pressures (in. wg).
2. Dampers shall have a minimum velocity rating of 2000 fpm at a pressure rating of 4 in. wg.
3. Dampers in systems operating above 2000 fpm or 4 in. wg shall be selected for a velocity rating of 4000 fpm at a pressure rating of 6 in. wg or a velocity rating of 6000 fpm at a pressure rating of 8 in. wg as required.

H. Types:

1. Curtain: for use in systems up to 4000 fpm velocity; Style B or C with the blade stack out of the airstream (Style A with the blade stack in the airstream may be used behind registers and grilles or where space conditions do not permit the use of a Style B damper).
   a. Construction:
      1) Frame: Galvanized steel (in gauges required by manufacturer's UL listing).
      2) Blade design: interlocking galvanized steel
      3) Sleeves: Damper shall be supplied as a single assembly with a factory sleeve.
      4) Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
      5) Duct Transition Connection: breakaway type

2. Round: for use in systems up to 2000 fpm velocity.
   a. Construction:

1) Frame: Galvanized steel (in gauges required by manufacturer's UL listing).
2) Blade design: single galvanized steel blade (in gauge required by manufacturer's UL listing).
3) Retainer plate(s): supplied with damper.
4) Sleeves: Length as required per wall thickness.
5) Duct Transition Connection: breakaway type.

3. Multi-blade:
   a. Up to 2000 fpm velocity: Triple vee-groove type blade.
   b. Construction:
      1) Frame: Galvanized steel with mitered and interlocking corners (in gauges required by manufacturer's UL listing).
      2) Blade design: 16 ga. galvanized steel strengthened by three longitudinal 1" deep Vee grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.
      3) Sleeves: Damper shall be supplied as a single assembly with a factory sleeve.
      4) Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
      5) Duct Transition Connection: breakaway type

I. All dampers shall be installed in strict accordance with the manufacturer's UL approved installation details.

J. Where fire dampers are required in a fibrous glass ductboard system, provide sheet metal sleeve per manufacturer's UL installation instructions. Verify gage of sleeve and attachment angle with governing code authorities. Installation shall also conform to SMACNA Figure 5-9 "Fibrous Glass Duct Installation".

2.04 CEILING RADIATION DAMPERS

A. A listed ceiling radiation damper shall be installed at all locations where ductwork or register, diffuser, grille, etc. penetrates the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly. Ceiling radiation dampers shall have a rating compatible with the floor/ceiling or roof/ceiling assembly and shall be tested to UL Standard 555C.

B. Fire Resistance Rating: 1 hour (minimum).

C. Closure device: Each ceiling radiation damper shall be equipped with a factory installed heat responsive device (fusible link) rated to close the damper when temperature at the damper reaches: 165°F.

D. Construction:

1. Dampers shall be factory-built curtain or butterfly type. They shall conform to the requirements of NFPA Standard 90A and be UL Labeled for the required assembly rating.
2. All dampers shall be installed in strict accordance with the manufacturer's UL approved installation instructions.
3. Provide steel sleeves, mounting angles and steel duct drops of design and length where required to permit mounting within the opening.
4. Provide thermal blanket where required by the manufacturer's UL installation instructions.
5. Where ceiling radiation dampers are shown on the drawings, and if fiberglass ductwork is used, dampers shall be installed with a sheet metal collar or housing or shall be listed for use with fiberglass ductwork.
6. Where fiberglass ductboard plenums are used they shall conform to manufacturer's Fiberglass Ductboard Plenum Installation Instructions.

2.05 COMBINATION FIRE AND SMOKE DAMPERS

A. Fire/smoke dampers shall be installed at all locations where ductwork or supply or return air openings penetrate any floor, wall or partition with a fire and smoke rating, or where otherwise shown on the drawings.

B. Fire/smoke dampers shall be provided with actuators capable of closing the damper on activation of area smoke detectors, the fire alarm system and/or the Firefighter's Smoke Control Panel and shall be normally closed. Actuators shall be compatible with the activating smoke detectors or fire alarm system (coordinate with other trades).

C. Unless otherwise indicated, smoke detectors integral to the combination fire/smoke damper shall be furnished and installed by the fire alarm contractor (coordinate with other trades).

D. All combination fire/smoke dampers shall be of the "Dynamic" type as classified in UL Standards 555 and 555S.

E. Fire/smoke dampers shall have a rating compatible with the floor, wall or partition, shall be tested to UL Standards 555 and 555S and be labeled for the intended installation (horizontal or vertical).

F. Maximum pressure drop: 0.10 in. wg; provide ductwork transitions as required so as not to exceed maximum pressure drop.

G. Fire Resistance Rating: 1½ hours unless noted otherwise on drawings for 3 hours.

H. Leakage Rating: Class 1 (maximum of 8 cfm/ft^2 at 4 in. wg) unless noted otherwise.

I. Elevated Temperature Rating: 350°F (177°C) for 30 minutes.

J. Airflow Closure Rating:

1. Dynamic fire/smoke dampers shall be selected for the velocity and pressure rating of the intended installation. Refer to the plans and schedules for airflow rates (CFM) and pressures (in. wg).
2. Dampers shall have a minimum velocity rating of 2000 fpm at a pressure rating of 4 in. wg.
3. Dampers in systems operating above 2000 fpm or 4 in. wg shall be selected for a velocity rating of 4000 fpm at a pressure rating of 6 in. wg or a velocity rating of 6000 fpm at a pressure rating of 8 in. wg as required.

K. Types:

1. Round: for use in systems up to 3000 fpm velocity.
   a. Construction:
      1) Frame: Galvanized steel (in gauges required by manufacturer's UL listing).
      2) Blade design: single galvanized steel blade (in gauge required by manufacturer's UL listing).
      3) Retainer plate(s): supplied with damper.
      4) Sleeves: Length as required per wall thickness.
      5) Duct Transition Connection: breakaway type.

2. Multi-blade:
   a. Up to 2000 fpm velocity: Triple Vee-groove type blade.
   b. Construction:
      1) Frame: Galvanized steel with mitered and interlocking corners (in gauges required by manufacturer's UL listing).
      2) Blade design: 16 ga. galvanized steel strengthened by three longitudinal 1" deep Vee grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.
      3) Blade Stops: Each blade stop (at top and bottom of damper frame) shall occupy no more than ½" of the damper

opening area to allow for maximum free area and to minimize pressure loss across the damper.

4) Seals:
   a) Blade Edge: Blade seals shall be extruded silicone rubber permanently bonded to the appropriate blade edges.
   b) Jamb: Flexible stainless-steel compression type.
5) Linkage: Concealed in jamb.
6) Axles: Minimum ½" diameter plated steel.
7) Bearings: Axle bearings shall be sintered bronze sleeve type rotating in polished extruded holes in the damper frame.
8) Sleeves: Damper shall be supplied as a single assembly with a factory sleeve.
9) Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
10) Duct Transition Connection: breakaway type

L. Heat Responsive Device: Electric, controlled closure, quick detect heat-actuated device designed to prevent damage to ductwork and other HVAC system components. The device shall be a reusable/resettable link (RRL) with a temperature setting of 165°F (74°C).

M. Damper Motors: Two-position meeting the following:

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, efficiency requirements and the following:
   a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so the driven load will not require motor to operate in service factor range above 1.0.
   b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
   c. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   d. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
   e. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40°F (minus 40°C).

f. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
g. Electrical Connection: 115 V, single phase, 60 Hz.

N. Momentary Test Switch (for use in combination fire and smoke dampers that are not part of a smoke management system): factory mounted and wired assembly for testing and cycling the damper during start-up and maintenance.

O. Accessories for active smoke management systems:

1. Open Closed Indicator (OCI): factory mounted and tested with two switches, one set to close when the damper blades are at their open position, and the other set to close when the damper blades are at their closed position. This will be wired to the Fire Fighter's Smoke Control Station to indicate true damper position.
2. Temperature Limited Override: factory mounted and tested with two temperature sensing devices (thermostats) with fixed settings (165°F [74°C] and 350°F [177°C]). The primary sensor (with the 165°F [74°C] setting) may be bypassed by an external electrical signal allowing the damper to reopen and remain open until the temperature reaches the setting of the secondary sensor (350°F [177°C]). When the temperature of the secondary sensor is exceeded, the damper closes and remains closed thereafter.
3. Test Switch and Indicator Panel: 5" x 5" control panel with toggle switch, red LED (replaceable) indicator light to indicate closed damper position and a green LED (replaceable) indicator light to indicate open damper position.

P. Combination Fire and Smoke Dampers shall have a single point wiring per UL requirements (except where two signals are required as with the Temperature Limited Override specified above).

2.06 CORRIDOR COMBINATION FIRE AND SMOKE DAMPERS

A. Corridor fire/smoke dampers shall be installed at all locations where ductwork or supply or return air openings penetrate any tunnel corridor ceiling with a fire and smoke rating, or where otherwise shown on the drawings.

B. Corridor fire/smoke dampers shall be provided with actuators capable of closing the damper on activation of area smoke detectors, the fire alarm system and/or the Firefighter's Smoke Control Panel and shall be normally closed. Actuators shall be compatible with the activating smoke detectors or fire alarm system (coordinate with other trades).

C. Unless otherwise indicated, smoke detectors integral to the corridor fire/smoke damper shall be furnished and installed by the fire alarm contractor (coordinate with other trades).

D. All corridor fire/smoke dampers shall be of the "Dynamic" type as classified in UL Standards 555 and 555S.

E. Corridor fire/smoke dampers shall be tested to UL Standards 555 and 555S and be labeled for the intended installation.

F. Maximum pressure drop: 0.10 in. wg; provide ductwork transitions as required so as not to exceed maximum pressure drop.

G. Fire Resistance Rating: 1 hour.

H. Leakage Rating: Class 1 (maximum of 8 cfm/ft^2 at 4 in. wg) unless noted otherwise.

I. Airflow Closure Rating:

1. Dynamic fire/smoke dampers shall be selected for the velocity and pressure rating of the intended installation. Refer to the plans and schedules for airflow rates (CFM) and pressures (in. wg).
2. Dampers shall have a minimum velocity rating of 2000 fpm at a pressure rating of 4 in. wg.

J. Types:

1. Round: for use in systems up to 3000 fpm velocity.
   a. Construction:
      1) Frame: Galvanized steel (in gauges required by manufacturer's UL listing).
      2) Blade design: single galvanized steel blade (in gauge required by manufacturer's UL listing).
      3) Retainer plate(s): supplied with damper.
      4) Sleeves: Length as required per wall thickness.
      5) Duct Transition Connection: breakaway type.

2. Multi-blade:
   a. Up to 2000 fpm velocity: Triple vee-groove type blade.
   b. Construction:
      1) Frame: Galvanized steel with mitered and interlocking corners (in gauges required by manufacturer's UL listing).
      2) Blade design: 16 ga. galvanized steel strengthened by three longitudinal 1" deep Vee grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance

characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.

3) Blade Stops: Each blade stop (at top and bottom of damper frame) shall occupy no more than ½" of the damper opening area to allow for maximum free area and to minimize pressure loss across the damper.
4) Seals:
   a) Blade Edge: Blade seals shall be extruded silicone rubber permanently bonded to the appropriate blade edges.
   b) Jamb: Flexible stainless-steel compression type.
5) Linkage: Concealed in jamb.
6) Axles: Minimum ½" diameter plated steel.
7) Bearings: Axle bearings shall be sintered bronze sleeve type rotating in polished extruded holes in the damper frame.
8) Sleeves: Damper shall be supplied as a single assembly with a factory sleeve.
9) Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
10) Duct Transition Connection: breakaway type

K. Damper Motors: Two-position meeting the following:

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, efficiency requirements and the following:
   a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so the driven load will not require motor to operate in service factor range above 1.0.
   b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
   c. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   d. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
   e. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40°F (minus 40°C).

f. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
g. Electrical Connection: 115 V, single phase, 60 Hz.

L. Momentary Test Switch (for use in combination fire and smoke dampers that are not part of a smoke management system): factory mounted and wired assembly for testing and cycling the damper during start-up and maintenance.

M. Combination Fire and Smoke Dampers shall have a single point wiring per UL requirements (except where two signals are required as with the Temperature Limited Override specified above).

2.07 SMOKE DAMPERS

A. Smoke dampers shall be installed at all locations where ductwork or supply or return air openings penetrate any floor, wall or partition with a smoke rating, or where otherwise shown on the drawings, except where such ductwork or openings are part of an engineered smoke removal system.

B. Smoke dampers shall be provided with actuators capable of closing the damper on activation of area smoke detectors, the fire alarm system and/or the Firefighter's Smoke Control Panel and shall be normally closed. Actuators shall be compatible with the activating smoke detectors or fire alarm system (coordinate with other trades).

1. For stair and elevator hoist-way pressurization fans, provide a Class 1, normally open smoke damper at the fan inlet for use as a control damper; Ruskin Model SD60 or equal.

C. Unless otherwise indicated, smoke detectors integral to the smoke damper shall be furnished and installed by the fire alarm contractor (coordinate with other trades).

D. All smoke dampers shall be tested and certified in accordance with UL Standard 555S.

E. Maximum pressure drop: 0.10 in. wg; provide ductwork transitions as required so as not to exceed maximum pressure drop.

F. Leakage Rating: Class 1 (maximum of 8 cfm/ft^2 at 4 in. wg) unless noted otherwise.

G. Elevated Temperature Rating: 350°F (177°C) for 30 minutes.

H. Airflow Closure Rating:

1. Dynamic smoke dampers shall be selected for the velocity and pressure rating of the intended installation. Refer to the plans and schedules for airflow rates (CFM) and pressures (in. wg).
2. Dampers shall have a minimum velocity rating of 2000 fpm at a pressure rating of 4 in. wg.
3. Dampers in systems operating above 2000 fpm or 4 in. wg shall be selected for a velocity rating of 4000 fpm at a pressure rating of 6 in. wg or a velocity rating of 6000 fpm at a pressure rating of 8 in. wg as required.

I. Types:

1. Round: for use in systems up to 3000 fpm velocity.
   a. Construction:
      1) Frame: Galvanized steel (in gauges required by manufacturer's UL listing).
      2) Blade design: single double skin galvanized steel blade (in gauge required by manufacturer's UL listing).
      3) Retainer plate(s): supplied with damper.
      4) Sleeves: Length as required per wall thickness.
      5) Duct Transition Connection: breakaway type.

2. Multi-blade:
   a. Up to 2000 fpm velocity: Triple Vee-groove type blade.
   b. Construction:
      1) Frame: Galvanized steel with mitered and interlocking corners (in gauges required by manufacturer's UL listing).
      2) Blade design: 16 ga. galvanized steel strengthened by three longitudinal 1" deep Vee grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.
      3) Blade Stops: Each blade stop (at top and bottom of damper frame) shall occupy no more than ½" of the damper opening area to allow for maximum free area and to minimize pressure loss across the damper.
      4) Seals:
         a) Blade Edge: Blade seals shall be extruded silicone rubber permanently bonded to the appropriate blade edges.
         b) Jamb: Flexible stainless-steel compression type.
      5) Linkage: Concealed in jamb.
      6) Axles: Minimum ½" diameter plated steel.

7) Bearings: Axle bearings shall be sintered bronze sleeve type rotating in polished extruded holes in the damper frame.
8) Sleeves: Damper shall be supplied as a single assembly with a factory sleeve.
9) Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
10) Duct Transition Connection: breakaway type

J. Damper Motors: Two-position meeting the following:

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, efficiency requirements and the following:
   a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so the driven load will not require motor to operate in service factor range above 1.0.
   b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
   c. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   d. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
   e. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40°F (minus 40°C).
   f. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
   g. Electrical Connection: 115 V, single phase, 60 Hz.

K. Momentary Test Switch (for use in smoke dampers that are not part of a smoke management system): factory mounted and wired assembly for testing and cycling the damper during start-up and maintenance.

L. Accessories for active smoke management systems:

1. Open Closed Indicator (OCI): factory mounted and tested with two switches, one set to close when the damper blades are at their open position, and the other set to close when the damper blades are at their

closed position. This will be wired to the Fire Fighter's Smoke Control Station to indicate true damper position.

2. Test Switch and Indicator Panel: 5" x 5" control panel with toggle switch, red LED (replaceable) indicator light to indicate closed damper position and a green LED (replaceable) indicator light to indicate open damper position.

2.08 CONTROL DAMPERS

A. Automatic control dampers shall be installed as shown on the drawings and shall be controlled as described in the 23 09 00 - Automatic Controls section of these specifications.

B. Unless indicated otherwise, dampers shall be of the opposed blade type constructed of minimum 18-gauge galvanized steel and shall have rigidly constructed blades less than 6" wide and shall have duct mounting flanges.

C. Dampers shall be the low leakage type with replaceable blade and jamb seals. Maximum pressure drop for dampers operating in systems exceeding 2000 fpm shall be 0.10 in. wg.

D. Outside air supply and exhaust openings shall be provided with a Class 1A motorized damper with a maximum leakage rate of 4 cfm/ft^2 (20.3 L/s · m^2) at 1.0 in. wg (249 Pa) when tested in accordance with AMCA 500D.

1. Gravity (non-motorized) dampers having a maximum leakage rate of 20 cfm/ft^2 (101.6 L/s · m^2) at 1.0 in. wg (249 Pa) when tested in accordance with AMCA 500D may be used in any one of the following conditions:
   a. In buildings for exhaust and relief dampers.
   b. In buildings of less than three stories in height above grade.
   c. For ventilation air intakes and exhaust and relief dampers in buildings of any height in Climate Zones 1, 2 and 3.
   d. Where the design outdoor air intake or exhaust capacity does not exceed 300 cfm (141 L/s).

   Gravity (non-motorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.
2. Dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage rate of 40 cfm/ft2 (203.2 L/s · m2) at 1.0 in. wg (249 Pa) when tested in accordance with AMCA 500D.

2.09 REMOTE DAMPER OPERATORS

A. Cable operated type:

1. Manufacturers: Subject to compliance with all requirements: Pottorff, Ventfabrics, Inc., Duro Dyne or Young Regulator Company.

2. Description: Cable system designed for remote manual damper adjustment.
3. Cable: Stainless steel with flexible steel casing.
4. Control: Concealed regulator kit with steel locking rack and pinion gear with hex head adjustment. Damper control is via push-pull lever action.
5. Wall-Box Mounting: Recessed
6. Wall-Box Cover-Plate Material: Steel

B. Install in strict conformance with manufacturer's installation instructions.

2.10 FLEXIBLE DUCT CONNECTORS

A. Install flexible duct connectors at connections of sheet metal duct to motor driven equipment, in ductwork crossing building expansion joints, or otherwise noted. Install per manufacturer's instructions, and support sheet metal ductwork so that no weight is supported by the flexible duct connector.

B. Basis-of-Design Product unless noted otherwise below: Subject to compliance with requirements, provide Ductmate Industries, Inc.; PROflex or comparable product by one of the following:

1. Duro Dyne Inc.
2. Ventfabrics, Inc
3. Prior Approved Equal

C. Materials: Flame-retardant or noncombustible fabrics compliant with NFPA 701.

D. Coatings and Adhesives: Comply with UL 181, Class 1 and have a maximum flame spread/smoke developed rating of 25/50.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip 5¾-inches wide attached to two strips of 2¾-inch wide, 0.028-inch thick, galvanized sheet steel. Provide metal compatible with connected ducts.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200ºF.

G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.

2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250ºF.

2.11 ACCESS DOORS

A. Hinged, gasketed and latched Access Doors (AD) and/or panels shall be installed at each fire and smoke damper, each duct mounted smoke detector, each valve, at each duct mounted balancing damper or any other mechanical equipment or device that requires accessibility. Doors and panels shall be sized (minimum 18" x 18", duct size allowing), and located to optimize access to dampers, detectors, and other equipment for service and replacement. Access Panels (AP) in walls, ceilings or other surfaces shall be coordinated with architectural finishes and selected by the architect.

B. Access doors shall be designed for five times the pressure of the duct in which it is mounted.

C. Access doors for fire dampers, combination fire/smoke dampers and smoke dampers in medium pressure (+4 in.wg and higher) duct systems shall be the implosion type designed to prevent excessive negative pressure downstream resulting in collapsed ductwork. At the contractor's option, the access door may be an integral feature of the damper assembly.

D. Access doors for grease exhaust ducts shall be in accordance with NFPA 96 (latest edition). Vertical grease ducts shall have an access door at each floor level in an inconspicuous location.

E. Access doors for fire dampers, combination fire/smoke dampers and smoke dampers shall be permanently identified by a die-cut label with ½" high red block letters on a white background. Label shall read FIRE DAMPER, COMBINATION FIRE/SMOKE DAMPER or SMOKE DAMPER.

F. Duct-Mounted Access Doors: Fabricate access panels per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct".

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ductmate Industries, Inc.; Access Doors or comparable product by one of the following:
   a. American Warming and Ventilating; a division of Mestek, Inc.
   b. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
   c. Prior Approved Equal
2. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

c. Vision Panel:
   1) Observation type doors shall be sandwich type provided at all fire and smoke dampers, humidifiers, in-duct smoke detectors, and UVC emitters.
   2) Minimum 12"x12" with 8"x8" viewport, insulated or non-insulated.
   3) For ducts smaller than 12-inches, 10"x6" shall be used with a 4"x 2-5/8" viewport with a single pane of safety glass.
d. Hinges and Latches: 1"x1" butt or piano hinge with cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

3. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
4. Number of Hinges and Locks:
   a. Access Doors Less Than 12 inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 inches Square: Continuous hinge and two sash locks.
   c. Access Doors up to 24 by 48 inches: Continuous hinge and two compression latches.
   d. Access Doors Larger Than 24 by 48 inches: Continuous hinge and two compression latches.

G. Pressure Relief Access Door:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. American Warming and Ventilating; a division of Mestek, Inc.
   b. Cesco Products; a division of Mestek, Inc.
   c. Elgen Manufacturing
   d. Flexmaster U.S.A., Inc.
   e. Greenheck Fan Corporation
   f. McGill AirFlow LLC
   g. Nailor Industries Inc.
   h. Pottorf
   i. Ventfabrics, Inc.
   j. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
   k. Prior Approved Equal
2. Door and Frame Material: Galvanized sheet steel.
3. Door: Single or Double wall with insulation fill, as required, with metal thickness applicable for duct pressure class.
4. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
5. Factory set at 3.0- to 8.0-in. wg.
6. Doors close when pressures are within set-point range.
7. Hinge: Continuous piano
8. Latches: Cam
9. Seal: Neoprene or foam rubber

10. Insulation Fill: 1" thick, fibrous-glass or polystyrene-foam board.

H. Duct Access Panel Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ductmate Industries, Inc.; Ultimate Door or comparable product by one of the following:
   a. Flame Gard, Inc.
   b. Prior Approved Equal
2. UL 1978 listed by an NRTL
3. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.
4. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
5. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000ºF.
6. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.12 DUCT LINER

A. Also refer to Section 23 07 00 - HVAC Insulation.

B. Supply air ductwork a minimum of 15 linear feet (or as indicated) downstream of low-pressure air handling equipment and terminal units shall be internally lined with 1½" thick acoustical duct liner/insulation (minimum R-6 or greater where required by code), Johns Manville Linacoustic RC or approved equal.

1. Duct liner shall be securely fastened to ductwork with stick pins, speed washers and adhesive. Leading edges of liner in medium pressure ductwork shall have a sheetmetal nosing.
2. Exposed edges and butt joints shall be “buttered” with duct sealer.

C. Supply air ductwork a minimum of 50 linear feet (or as indicated) downstream of static pressure class +4 in. wg air handling equipment shall be internally lined with 1½" thick acoustical duct liner/insulation, (minimum R-6 or greater where required by code) Johns Manville Linacoustic RC or approved equal.

D. Return air ductwork, sound boots and transfer ducts shall have 1" thick liner, Johns Manville Linacoustic RC or approved equal.

1. Refer to Section 23 07 00 - HVAC INSULATION for return air ductwork requiring external insulation.

E. Indoor exposed round, spiral or flat oval ductwork shall be lined with 1" thick fiberglass duct liner/insulation (minimum R-4 or greater where required by code) Johns Manville Spiracoustic Plus or approved equal.

F. Subject to compliance with requirements, duct liner products shall be manufactured by: CertainTeed, Johns Manville, Knauf, Owens Corning, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All ductwork shall be installed in accordance with applicable SMACNA Standards according to the pressure class described in PART 1 - GENERAL.

B. Seal, inspect and test ductwork prior to insulating or concealing. Seal all ductwork and plenums to meet the following SMACNA duct seal class:

1. Class A: Seal all transverse joint, longitudinal seams, and duct wall penetrations.
   a. Pressure-sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL 181A or UL 181B by an independent testing laboratory and the tape is used in accordance with that certification.
   b. All connections shall be sealed, including but not limited to spin-in fittings, taps, other branch connections, access doors, and duct connections to equipment.
   c. Sealing that would void product listings is not required.
   d. Spiral lock seams need not be sealed.
2. Tapes, sealants and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic/sealant.
3. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked "181B-C".

C. Ductwork shall be supported as recommended by SMACNA Standards from structural members. Ductwork shall not be allowed to rest on ceilings, light fixtures or structural members. Ductwork supported from joists shall be supported from the top chord of all joists.

D. All ductwork accessories shall be installed in strict accordance with manufacturer's recommendations.

E. Ductwork that is designed to operate at static pressures in excess of 3 in. wg and all ductwork located outdoors shall be leak-tested in accordance with SMACNA Standards. Representative sections totaling no less than 25% of the total installed duct area for the designated pressure class shall be tested. All sections shall be selected by the building owner or the designated representative of the building owner. Positive pressure leakage testing is acceptable for negative pressure ductwork. The maximum permitted duct leakage shall be:

$$L_{max} = C_L P^{0.65}$$

where

L_{max} = maximum permitted leakage, cfm per100 ft^2 of duct surface area

C_L = 4, duct leakage class, cfm per100 ft^2 of duct surface area per inch of $water^{0.65}$

P = test pressure, which shall be equal to the design duct pressure class rating, in. of water

All ductwork seams shall be sealed with mastic to provide a system that is within the recommended SMACNA leakage limits. As an alternate, water-based spray-on hardcast products may be used provided they meet or exceed the project requirements.

The ductwork test report shall be submitted in electronic (PDF) format to the Engineer prior to the Contractor's request for final payment.

F. All ductwork shall be cleaned inside and out prior to system start up and shall be left in a neat and orderly manner.

G. Duct sizes shown on drawings are inside clear dimensions.

H. Unless otherwise approved, ducts shall be true to dimensions indicated, straight and smooth on the inside with neatly finished joints, securely anchored to the building in an approved manner, and installed to be completely free from vibration under all conditions of operation. Exact routing of ductwork will be dependent on location of framing members. Route ductwork to avoid cutting framing members.

I. Brace ducts not more than 60 inches on center.

J. Make slip joints in the direction of air flow.

K. Offset ducts around obstructions where possible. Where duct must encompass obstruction, area of duct shall remain constant.

L. Duct tapers shall not exceed 1:4 ratio and transformations 30 degrees between air flow and diverging or converging air flow.

M. Provide access doors for access to all equipment, dampers and motors concealed by sheet metal.

N. Where applicable, provide seismic bracing and restraints for ductwork per ASCE 7-10 and the latest edition of the SMACNA Seismic Restraint Manual. Also, refer to Section 23 05 48 Noise and Vibration Control.

3.02 BALANCING DAMPERS

A. Install manual volume dampers where indicated on the drawings and where required to properly balance the air distribution system.

B. Provide an opposed blade damper behind the face of each supply register which shall be adjustable through the face of the register with a screwdriver.

C. Provide an opposed blade damper behind the face of return air registers, where indicated, which shall be adjustable through the face of the register with a screwdriver.

D. Provide a butterfly damper in the neck of each ceiling diffuser unless noted otherwise.

END OF SECTION

SECTION 23 34 00

UNITARY EXHAUST AND SUPPLY FANS AND VENTILATORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to specification section 23 00 00 - HVAC General, all of which applies to work described in this section as if written in full herein. Special attention should be given to Section 2.02 ELECTRICAL WORK for specifics on motor and drive requirements.

B. Furnish and install all unitary exhaust and supply fans and ventilators of the size, type, capacity and characteristics as shown on the equipment schedules and herein described.

C. Base fan-performance ratings on actual project site altitude.

D. Acceptable manufacturers include only those whose products have been in satisfactory use in similar service for not less than five (5) years.

E. Electrical Standards: Provide electrical motors and products which have been listed and labeled by Underwriters Laboratories Inc. and comply with NEMA Standards.

F. Certification, Fan Performance: Fans shall be certified to bear the AMCA label for air and sound performance.

PART 2 - PRODUCTS

2.01 CENTRIFUGAL AND AXIAL FANS AND VENTILATORS

A. All units shall be rigidly constructed of materials suitable for the intended service and shall be installed with all accessories listed on the Drawings.

B. All roof mounted units shall be installed on factory supplied 14-inch high (minimum) insulated roof curbs of the proper type, size and construction for proper mounting. Curbs shall account for all roof slopes and pitches so that the unit is installed level. Units shall be anchored to curbs by a minimum of two lag screws of adequate size on each side. Curbs shall be constructed of galvanized steel, except when the project is located within 5 miles of a sea coast they shall be of aluminum construction.

C. Outdoor fans shall be completely weatherproof for outdoor installation and shall contain internal vibration isolation to assure smooth and quiet performance.

D. Fan wheels and blades shall be constructed of aluminum and shall be statically and dynamically balanced at the factory.

2.02 CEILING-CENTRIFUGAL AND CABINET FANS

A. Units shall be direct-drive type with back-draft damper, acoustically insulated cabinets and speed controller.

PART 3 - EXECUTION

3.01 GENERAL

A. All units shall be installed in accordance with manufacturer's recommendations and as shown on the Drawings.

B. Ceiling-centrifugal and cabinet fans shall be supported from structural members and shall not rest on the ceiling, on lights or on structural members.

C. Units shall be interlocked and controlled as indicated on the Drawings.

D. Ceiling-mounted units shall be installed with ceiling grilles flush with the ceiling.

E. Curb-mounted fans shall be secured to the roof curb with lag screws in each hole in the fan curb cap.

F. Electrical connection to the fan motor shall be made through the roof opening inside the roof curb.

G. Replace fan and motor pulleys as required to achieve design airflow.

END OF SECTION

SECTION 23 37 00

LOUVERS, GRILLES, REGISTERS AND DIFFUSERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work in this section shall be subject to the provisions of Section 23 00 00 - HVAC General.

B. Furnish and install all louvers, grilles, registers and diffusers of the size, type, capacity, and characteristics as shown on the equipment schedules and specified herein.

C. Equipment schedules and specifications are intended to establish a minimum level of quality and workmanship for the project. When other than the basis of design equipment is proposed, the Contractor shall be responsible for all costs associated with engineering and construction modifications necessary in his or any other trade that may be required to satisfy the Contract Documents.

D. Refer to the drawings for basis of design manufacturer and acceptable alternates.

PART 2 - PRODUCTS

2.01 LOUVERS

A. Louver components (heads, jambs, sills, blades, etc.) shall be factory assembled by the manufacturer into a complete unit. Louver sizes too large for shipping shall be built-up from factory assembled louver sections to provide the overall sizes required.

B. Louver design shall incorporate structural supports required to withstand a wind load of 20 lbs./square foot.

C. All louver performance data submitted for approval shall bear the AMCA Certified Ratings Seal for Air Performance and Water Penetration.

D. All louvers shall have a factory applied finish coating as scheduled with the color selection made by the Architect at the time of shop drawing approval. Color charts shall be submitted with louver shop drawings.

E. Screens:

1. General: Provide a screen at each exterior louver.

2. Frames: Same kind and form of metal as indicated for louver to which screens are attached.
3. Screening material:
   a. Bird Screen: Flattened, expanded aluminum, ¾" by 0.050" (19 by 1.27 mm) thick
   b. Insect Screen: Aluminum, 16 x 18 square mesh, 0.011-inch wire

2.02 GRILLES, REGISTERS AND DIFFUSERS

A. Units shall be of the type, size, and construction as scheduled or indicated.

B. Unless otherwise noted or indicated, all air devices shall be supplied with a factory finish of manufacturer's standard white.

C. Grilles, registers and diffusers shall be ordered with borders compatible with the ceiling system type in which they are installed. Refer to architectural drawings for type of ceiling and/or suspension system.

D. Aluminum air devices shall be used for all areas subject to excessive moisture or humidity (e.g. showers, pools, bathrooms, etc.).

PART 3 - EXECUTION

3.01 LOUVERS

A. Louvers shall be installed in accordance with the manufacturer's recommendations.

B. The louver installation shall be made weatherproof by caulking and sealing at the frame and flanges in accordance with the manufacturer's recommendations.

C. Combination louver/dampers shall be installed with the required actuators and linkage mechanisms and shall be field adjusted for full opening/closure stroke. Louvers shall be interlocked as scheduled or indicated.

3.02 GRILLES, REGISTERS AND DIFFUSERS

A. All air devices located in ceiling tiles shall be centered or shall be on quarter points of 2 ft. x 2 ft. tiles.

B. Where a line of sight allows the ductwork, wall, or ceiling structure to be seen behind any units, such ductwork, wall or ceiling structure shall be painted with nonflammable flat black paint to minimize visibility.

C. All air devices not installed on T-bar ceiling grids shall be securely fastened to adjacent structures.

D. Where air distribution devices are installed in inaccessible ceilings, provide the spin-in fitting without a volume damper. Provide an opposed blade damper in the neck of the air distribution device with access to the damper control through or at the face of the device.

END OF SECTION

SECTION 23 81 28

SPLIT SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.

B. Furnish and install a direct expansion air-to-air heat pump unit of the size and capacity shown on the equipment schedule. The unit shall be completely factory assembled and tested, and shall include compressor, indoor and outdoor coils, stand-by electric strip heating coils, fan motors as required, pre-wired controls, interconnecting refrigerant tubing, wiring, and circuit breakers. Condensing unit shall be factory matched with evaporator coils and air handling unit; units shall be rated in accordance with AHRI and UL Listed.

C. Equipment schedules and specifications are intended to establish a minimum level of quality and workmanship for the project. When other than the basis of design equipment is proposed, the Contractor shall be responsible for all costs associated with engineering and construction modifications necessary in his or any other trade that may be required to satisfy the Contract Documents.

D. Refer to the drawings for basis of design manufacturer and acceptable alternates.

1.02 RELATED DOCUMENTS

A. **F**or piping, valves, accessories and piping insulation refer to Section 23 23 00 – Refrigerant Piping.

PART 2 - PRODUCTS

2.01 GENERAL

A. Each unit shall be a complete and factory package consisting of compressor, condenser coil, stand-by electric heating coil, condenser fans and motors, refrigeration and temperature controls, Unit shall have a certified AHRI rating.

2.02 AIR HANDLER

A. The cabinet shall be complete and constructed of minimum 20-gauge galvanized steel zinc coated and shall be painted with a baked-on powder coating finish. Interior surface of the cabinet shall be lined with a flexible acoustical and thermal

insulation and shall be fire proof. Thickness of insulation shall be 1-1/2". Access to fan motor, filters, coils, controls and power supply shall be through the front panel of the unit.

B. The nonferrous direct expansion cooling coil shall be factory mounted and charged with refrigerant. Provide reversing valve, expansion valve, solenoid valve and complete refrigeration circuit. Provide insulated drain pan with exterior primary and secondary drain connection.

C. The air handling unit shall accept a 1" thick high velocity air filter, mounted internally and located upstream of the cooling coil.

D. The blower section shall have an adjustable V-belt or direct drive fan motor with a forward-curved centrifugal type blower mounted on vibration isolators. The fan motor shall have thermal overloads and be permanently lubricated. Direct drive fan motors shall have at least three (3) speeds.

E. An electric resistance heater shall supplement the heat pump operation.

F. The unit shall be supplied with a single point power connection.

2.03 OUTDOOR UNIT

A. The cabinet shall be constructed of galvanized steel with a baked-on enamel finish. Provide with removable access panel at one side of unit to access the compressor, coil, controls, and power supply. Drain holes shall be provided at the base of the unit. Provide fan and coil guards.

B. The compressor shall be the hermetic scroll or rotary type, furnished with complete refrigeration circuit(s) including nonferrous condenser coil, receiver, charging valve, refrigerant holding charge, external service valves, compressor anti-cycle protection, internal temperature and current-sensing overloads, crankcase heater, filter drier, evaporator freeze stat, liquid line solenoid valve, and vibration isolation. Controls shall include over and under voltage protection, high pressure cutout with auto-reset, motor starters and contactors. Compressor shall have a five-year warranty.

C. The fan motor shall be permanently lubricated with built-in thermal overload protection.

D. Install unit level as indicated on the Drawings.

E. The unit shall be supplied with a single point power connection.

2.04 CONTROLS

A. Unless noted otherwise, provide a seven-day programmable thermostat with manual changeover.

B. The thermostat shall prevent the auxiliary electric heat from being energized whenever the heating load can be met by the heat pump.

PART 3 - EXECUTION

3.01 GENERAL

A. Units shall be installed as shown on the Drawings and in strict accordance with manufacturer's recommendations.

B. Units shall be installed level.

C. Units shall be installed to allow adequate service to all components.

END OF SECTION

SECTION 23 81 28.13

DUCTLESS SPLIT SYSTEM HEAT PUMPS (1 to 3½ TONS)

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.

B. Furnish and install direct expansion air-to-air split system heat pump units of the size and capacity shown on the equipment schedule. The unit shall be completely factory assembled and tested, and shall include variable speed compressor, indoor and outdoor coils, fan motors, wireless or wired remote controller, interconnecting refrigerant tubing, and power and control wiring. The outdoor unit shall be of the inverter driven design and factory matched with the indoor unit.

C. Equipment schedules and specifications are intended to establish a minimum level of quality and workmanship for the project. When other than the basis of design equipment is proposed, the Contractor shall be responsible for all costs associated with engineering and construction modifications necessary in his or any other trade that may be required to satisfy the Contract Documents.

D. Refer to the drawings for basis of design manufacturer and acceptable alternates.

1.02 RELATED DOCUMENTS

A. **F**or piping, valves, accessories and piping insulation refer to Section 23 23 00 – Refrigerant Piping.

1.03 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (NEC).

C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute’s (AHRI) Standard 210/240 and bear the AHRI Certification label.

D. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001.

E. A dry air holding charge shall be provided in the indoor section.

F. System efficiency shall meet or exceed the scheduled values.

G. Delivery, Storage and Handling:

1. Equipment shall be stored and handled according to the manufacturer's recommendations.
2. The controller shall be able to withstand storage temperature of 105°F and 95% relative humidity without any adverse effects.

1.04 SUBMITTALS

A. Product Data: Include performance data (including extended capacity ratings if other than AHRI standard conditions are scheduled); installation, operation and maintenance manual; operating characteristics; furnished specialties; and accessories.

B. Submit AHRI Certificates.

1.05 COORDINATION

A. Coordinate size, weight and location with Architectural and Structural drawings. Where concrete pads are indicated, conform to Division 03 for concrete, reinforcement, and formwork requirements.

1.06 WARRANTY

A. The indoor and outdoor units shall carry a manufacturer's standard parts and defects warranty for a period five (5) years from the date of installation. The compressor shall carry a warranty of seven (7) years from the same date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

PART 2 - PRODUCTS

2.01 INDOOR UNITS

A. The indoor units shall be following types: wall mount, ceiling recessed cassette, ceiling suspended and horizontal ducted. All indoor units shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board, fan and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function after power interruption. Indoor unit shall be purged with dry air before shipment from factory.

B. Wall Mount Type:

1. Unit Cabinet:
   a. 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.
   b. A separate metal installation plate that secures the indoor unit firmly to the wall shall be furnished with the unit. The installation plate shall be securely attached to the wall using an appropriate anchoring method for the wall type the unit will be attached to.
2. Fan:
   a. The fan shall be a high performance direct drive double inlet forward curved sirocco type design driven by a single motor. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearings.
   b. The fan shall have three (3) speeds: Low, Mid, High 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.
3. Directional Air Flow Vane: An integral, motorized multi-position vane shall automatically direct air flow in a horizontal and downward direction to provide uniform air distribution.
4. Filter: Return air shall be filtered by means of an easily removable washable filter.
5. Coil:
   a. The indoor unit 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.
   b. All tube joints shall be brazed with PhosCopper or silver alloy.
   c. The coils shall be pressure tested at the factory.
   d. A condensate pan and drain shall be provided under the coil.
   e. Condensate overflow protection: a drain pan water level switch, designed to connect to the control board and shut the unit off, shall be provided when scheduled.
   f. A condensate mini-pump shall be provided when scheduled to provide a means of condensate disposal when a gravity drain is not available.

C. Ceiling Recessed Cassette Type:

1. Unit Cabinet:
   a. The cabinet shall be formed from galvanized sheet metal coated with high-density foam insulation. The cabinet shall be designed for recessed mounting and provided with four (4) corner mounting supports behind removable corner pockets located in the grille

assembly allowing adjustment of mounting height from the front of the unit.

b. The cabinet panel shall have provisions for a field installed filtered outside air intake.

c. The cabinet shall have a knock-out for the connection of a branch supply air duct to condition a secondary space.

d. The cabinet shall have an optional multi-function casement which will mount between the unit cabinet and the Grille assembly to provide a second field installed filtered outside air intake and provide a mount for a high-efficiency filter element.

e. A separate grille assembly shall be attached to the front of the cabinet with supply air vanes to supply air in four directions. The four-way grill shall allow two, three or four-way blow. The grille vane angles shall be individually adjustable from the wired remote controller. The return air intake shall be located in the center section of the grille. The grille assembly shall be white.

2. Fan:

a. The fan shall be a direct drive turbo propeller design driven by a single motor. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearings.

b. The fan shall have four (4) speeds: Low, Mid1, Mid2, High 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.

3. Directional Air Flow Vane: An integral, motorized multi-position vane shall automatically direct air flow in a horizontal and downward direction to provide uniform air distribution.

4. Filter:

a. Return air shall be filtered by means of an easily removable washable filter.

5. Coil:

a. The indoor unit coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow.

b. All tube joints shall be brazed with PhosCopper or silver alloy.

c. The coils shall be pressure tested at the factory.

d. A condensate pan and drain shall be provided under the coil.

e. Condensate overflow protection: a drain pan water level switch, designed to connect to the control board and shut the unit off, shall be provided when scheduled.

f. A condensate mini-pump shall be provided when scheduled to provide a means of condensate disposal when a gravity drain is not available.

D. Ceiling Suspended Type:

1. Unit Cabinet:
   a. The cabinet shall be formed from high strength molded plastic. Cabinet color shall be white.
   b. The cabinet shall be designed for overhead suspension mounting and horizontal operation.
   c. The unit shall have removable mounting brackets. A mounting template with suspension bolt locations shall be furnished with the unit. Mounting bolts or threaded rod of 3/8" diameter shall be used to suspend the unit and the unit shall not require direct contact with the ceiling for proper operation.
   d. The rear cabinet panel shall have knock-out provisions for a field installed filtered 4-5/16" diameter ventilation air intake connection.
2. Fan:
   a. The fan assembly shall have multiple high performance direct drive double inlet forward curved sirocco type wheels driven by a single motor. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearings.
   b. The fan shall have four (4) speeds: Low, Mid1, Mid2, High 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.
3. Directional Air Flow Vane: An integral, motorized multi-position vane shall automatically direct air flow in a horizontal and downward direction to provide uniform air distribution.
4. Filter:
   a. Return air shall be filtered by means of an easily removable washable filter.
5. Coil:
   a. The indoor unit 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.
   b. All tube joints shall be brazed with PhosCopper or silver alloy.
   c. The coils shall be pressure tested at the factory.
   d. A condensate pan and drain shall be provided under the coil.
   e. Condensate overflow protection: a drain pan water level switch, designed to connect to the control board and shut the unit off, shall be provided when
   f. An optional drain lift mechanism, capable of lifting condensate 23-5/8" above the drain pan shall be provided.
6. Electrical:
   a. The unit electrical characteristics shall be 208/230 volts, 1-phase, 60 hertz.
   b. The indoor unit will be powered directly from the outdoor unit.
   c. The indoor unit shall not have any supplemental electric heat.

E. Horizontal Ducted Type:

1. Unit Cabinet:
   a. The cabinet shall be the space saving, low profile, horizontal, ducted type. Formed cabinet shall be constructed of G-60 galvanized steel with factory applied foam surface insulation to prevent condensation on the outer surfaces. The cabinet shall be designed for overhead suspension mounting and horizontal operation.
   b. The cabinet shall be provided with four mounting brackets to accommodate suspension from threaded rod or structural supports located on the side panels at all four corners. Brackets shall be suitable for supporting the weight of the indoor unit. The cabinet shall be equipped with a ducted air outlet and ducted rear return air connection.
   c. The rear cabinet panel shall have knock-out provisions for a field installed filtered 3-5/16" diameter ventilation air intake connection.
2. Fan:
   a. The fan assembly shall have multiple high performance direct drive double inlet forward curved sirocco type wheels driven by a single motor. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearings.
   b. The fan shall have three (3) speeds: Low, Mid, High 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.
3. Filter:
   a. Return air shall be filtered by means of a standard factory installed return air filter.
4. Coil:
   a. The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow.
   b. All tube joints shall be brazed with PhosCopper or silver alloy.
   c. The coils shall be pressure tested at the factory.
   d. A condensate pan and drain shall be provided under the coil.
   e. In addition to the gravity drain, the unit shall be provided with an integral condensate lift mechanism able to raise the condensate above the pan. The lift mechanism shall incorporate a safety sensor system to shut down the indoor fan and the outdoor unit in the event a high level of condensate is detected in the drain pan.
   f. Condensate overflow protection: a drain pan water level switch, designed to connect to the control board and shut the unit off, shall be provided when scheduled.

5. Electrical:
   a. The unit electrical characteristics shall be 208/230 volts, 1-phase, 60 hertz.
   b. The indoor unit will be powered directly from the outdoor unit.
   c. The indoor unit shall not have any supplemental electric heat.

2.02 OUTDOOR UNIT

A. General:

1. The outdoor unit shall be specifically designed and matched to operate with the indoor unit. The outdoor unit shall be completely factory assembled, piped and wired and run tested at the factory.
2. The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.
3. The unit shall be capable of cooling operation down to 23°F (-5°C) ambient temperature without additional low ambient controls (an optional wind baffle shall be required for cooling operation down to 0°F (-17.7°C). Heating shall be available between 17°F (-8°C) and 70°F (21°C) ambient without any additional controls or accessories.
4. The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between the indoor and outdoor units.
5. System shall be capable of operation up to a maximum refrigerant tubing length of 100 feet (30 meters) for the 1 and 1½ ton units and 165 feet (50 meters) for the 2 thru 3½ ton units between indoor and outdoor units without the need for line size changes, traps or additional oil.

B. Unit Cabinet:

1. The casing shall be fabricated of galvanized steel finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection.
2. Serviceable parts shall be accessible by means of removable panel sections.
2. Cabinet color shall be the manufacturer’s standard color.
3. The unit shall have two (2) mild steel mounting feet, transversely mounted and welded to the cabinet base pan. The mounting feet shall have a slotted mounting hole at each end for a total of four (4) mounting holes. The cabinet assembly shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas.

C. Fan:

1. The unit shall be furnished with single or dual direct drive fan wheels.

2. The fan motor shall be a direct current (DC) motor with permanently lubricated bearings.
3. The fan motor shall be mounted for quiet operation.
4. The unit shall be provided with a raised fan safety guard to prevent contact with moving parts.
5. The outdoor unit shall have horizontal discharge airflow.

D. Coil:

1. The L shaped condenser coil shall be constructed 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 outdoor unit shall be regulated by means of an electronic linear expansion valve (LEV) metering device.
3. The outdoor unit shall be pre-charged with sufficient R-410a refrigerant to accommodate up to twenty-five (25) feet of refrigerant piping for capacities up to 18,000 btu/hr., and up to thirty-three (33) feet of refrigerant piping for capacities above 18,000 btu/hr.
4. Refrigerant linesets between the outdoor and indoor units shall be annealed refrigeration grade copper tubing, Type ACR, meeting ASTM B280 requirements. The lines shall be 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 a thermal conductivity equal to or better than 0.27 BTU-inch/hour per ft^2/°F and a water vapor transmission equal to or better than 0.08 Perm-inch. Insulation thickness shall be as required to satisfy project specific energy code requirements (refer to Section 23 23 00 Refrigerant Piping for additional information). 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.
5. Refrigerant piping connections between the outdoor and indoor units shall be flare type.

E. Compressor:

1. The compressor shall be the high performance, hermetic, inverter driven, variable speed, dual rotary type.
2. The compressor motor shall be the direct current (DC) type equipped with a factory installed inverter drive package.
3. The outdoor unit shall be equipped with an accumulator and high pressure safety switch.
4. The compressor shall be equipped with internal thermal overload protection.
5. 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 will be required.

6. There shall be no need for line size changes. Filters, sight glasses, and traps shall not be used, and no additional refrigerant oil shall be required.
7. The compressor shall be resiliently mounted to reduce vibration transmission.

F. Electrical:

1. The unit electrical characteristics shall be 208/230 volts, 1-phase, 60 hertz and shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
2. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have a Pulse Amplitude Modulation circuit to utilize 98% of the input power supply.

2.03 CONTROLS

A. General:

1. The system shall have either a wired or wireless remote controller as scheduled to perform input functions necessary to operate the system.
2. The controllers shall have a Power On/Off switch, Mode Selector – Auto, Cool, Heat, Dry Modes - Temperature Setting, Timer Control with Clock, Fan Speed Select and Vane / Airflow Direction selector. Controllers shall have a programmable Smart Set button for pre-selected Temperature, Fan Speed, and Vane position settings.
3. The controller shall support multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information.
4. The indoor unit shall be capable of performing self-diagnostic functions and check mode switching.
5. Temperature changes shall be displayed in 1ºF (1ºC) increments with a range of 61 - 88ºF (16-31ºC).
6. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.
7. The system shall be capable of automatically restarting and operating at the previously selected conditions when the power is restored after power interruption.
8. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off, System/Mode function.
9. Controller options:
   a. Wireless, wall mounted remote controller kit: The kit shall consist of a wireless, wall mounted controller, a wireless receiver and

interconnecting cable to connect the receiver to the indoor unit. The controller shall have a light-green LCD display and a backlight feature. The controller shall consist of four Function buttons below the display, Increase/Decrease Set Temperature buttons and a Hold button to the right of the display. The controller shall have a built-in temperature sensor and a battery holder, requiring two AA alkaline batteries (contactor furnished).

Linking to a wireless network shall be done from the receiver and from the remote controller. Communication shall be automatically restored after power resumes and after batteries are replaced.

b. Wired wall mounted remote controller: The wired remote controller shall be furnished with a communications interface to communicate with the indoor unit. The interface will be mounted at the indoor unit.

The wired remote controller shall have a light-green LCD display. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor.

2.04 ACCESSORIES

A. Wind Guard/Baffle: if specified or if required to achieve proper operation due to high wind conditions and/or low ambient operation.

B. Wall mounting bracket (if specified): factory fabricated painted steel bracket to accept outdoor unit mounting holes, secure to wall and provide manufacturer recommended airflow and maintenance clearances.

C. Air outlet guide: provide where multiple units are arranged for series airflow at less than manufacturer’s recommended airflow clearance.

D. Outdoor drain pan with drain connection: provide where outdoor units are subject to defrost and located in an area where melting ice could pose a nuisance/safety issue. Extend drain piping to a safe area.

E. Condensate pump: provide where condensate drain piping cannot be installed to achieve gravity flow.

PART 3 - EXECUTION

3.01 GENERAL

A. Units shall be installed as indicated and in strict accordance with manufacturer's recommendations and installation instructions.

B. Units shall be installed level.

C. Test for positive condensate drainage.

D. Units shall be installed to allow adequate service to all components.

E. Review the Installation, Operation, and Maintenance Manual with the Owner's representative.

END OF SECTION

SECTION 23 82 39.19

ELECTRIC WALL HEATERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.

1.02 WORK INCLUDED

A. Receipt, unloading, handling, proper storage and protection from damage of all materials.

B. Layout and coordination of work with other trades.

C. The work under this section shall include all labor, materials, accessories, services, and equipment necessary to furnish and install wall heaters complete as indicated on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.01 WALL HEATERS

A. Unit shall be completely factory assembled, wired, tested and shipped as a single assembly; capacity shall be as indicated on the Drawings.

B. Unit heaters shall be constructed in accordance with provisions of the National Electrical Code and shall be UL or ETL tested and listed to UL Standard 2021 – UL Standard for Safety Fixed and Location-Dedicated Electric Room Heaters.

C. Front grille shall be 16-gauge steel or aluminum finished in baked enamel or anodized with downflow discharge louvers.

D. Element shall consist of helically coiled nickel chromium alloy resistance wire enclosed in corrosion resistant sheaths.

E. Controls shall include fan delay switch, built-in thermostat, automatic reset thermal overload switch and a non-fused disconnect power switch.

F. Unit shall be designed to either recess into the wall or for surface mounting as scheduled, and shall include all mounting accessories.

G. Unit shall be Raywall, QMark, Markel, Berko, Indeeco or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All units shall be installed in strict accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 26 00 00

ELECTRICAL GENERAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work to be done under this section of the specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of systems for power, lighting, signals and all other work indicated on the drawings or as specified herein. A 100% operational building and electrical distribution system up to a connection point for Owner furnished equipment will be provided.

C. The drawings and specifications are complementary to each other and what is called for by one shall be as binding as if called for by both.

1.02 STANDARDS

A. All work shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides:

1. The _____ edition of the National Electrical Code (NFPA 70) with local Amendments
2. The _____ edition of the International Building Code with local Amendments
3. The _____ edition of the Life Safety Code (NFPA 101)
4. LEED [yyyy] for [New Construction]
5. ASHRAE 90.1-[2007][2010]
6. Regulations of the local utility company with respect to metering and service entrance
7. Local city and county ordinances governing electrical work
8. Americans with Disabilities Act (Public Law 101-336)

1.03 PERMITS

A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.04 WORK INCLUDED

The electrical systems installed and work performed under this division of the specifications shall include, but not necessarily be limited to, those listed below. All materials and appliances, obviously a part of the electrical systems and necessary to its proper operation, but not specifically mentioned or shown on the drawings, shall be furnished and installed without additional charge.

A. Power Distribution System

B. All lighting systems (indoor and outdoor, normal, emergency and exit) including all fixtures, lamps, plaster and/or tile frames, standards, switches, outlets, wiring, dimmers, contactors, time clocks, photocells, batteries, raceways and other components and fittings required for complete lighting systems

C. Wiring, including power circuit connections for HVAC, plumbing and other mechanical equipment

D. Grounding Systems

E. Temporary service lighting and power system

F. Low voltage system raceways and equipment mounting boards as indicated on the drawings

G. Underground raceway excavation, backfill, and compaction

H. Fire Alarm System

I. Concrete work for duct banks, manholes, covering, lighting standard bases and equipment bases (where not assigned to General Contractor)

J. Lightning Protection System

K. Electrical Equipment Identification

L. Supporting Devices for Electrical Components

M. Work as required by electric and telecommunication utilities, as well as the coordination of additional work (i.e. work performed by the utility) with that of other trades

N. Electrical Demolition

1.05 DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of fixtures, equipment and conduit. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to rearrange conduit or equipment, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.

B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

D. Locate pull boxes, panelboards, control pushbuttons, terminal cabinets, safety switches and such other apparatus as may require periodic maintenance, operation, or inspection, so that they are easily accessible. If such items are shown on the plans in locations which are found to be inaccessible, the Engineer must be advised of the situation before work is advanced to the point where extra costs will be involved.

E. All additional circuit connections to panelboards must be preapproved by the Engineer.

F. The location, arrangement and extent of equipment, devices, conduit, and other appurtenances related to the installation of electrical work shown on drawings are approximate. The Contractor shall not scale drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy.

G. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering lighting fixtures. Notify the Engineer of any discrepancies.

H. Review all architectural drawings for door swings, cabinets, counters and built-in equipment.

1.06 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review, describing installation, operation and maintenance of all Electrical equipment. Manuals shall include copies of control schematics, sequences of operation, indicate the function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturer's drawings, pamphlets, data, parts lists, and instruction manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in a 3-ring binder(s).

1.07 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record of all changes in the work from that shown in the Contract Documents. After all work is completed, the Contractor shall prepare a set of "as-built" reproducible drawings of similar type and quality as the Contract Drawings that reflect all changes and that accurately show actual final construction, and deliver these drawings to the Architect.

1.08 EQUIPMENT, MATERIALS AND BID BASIS

A. Manufacturers' names, model numbers, etc. as specified on the drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless "approved equal" is specifically stated, bids shall be based on equipment names in specifications or on drawings as "base" products.

C. "Equal product" and "approved equal" items listed shall conform to specified base items and shall be substantially equal in size, weight, construction and capacities. The "equal" equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. Submittals for "equal" products shall be made at least ten (10) days prior to bid (refer to the General Conditions of these specifications). The Engineer shall consider the use of the "equal" equipment based on the supportive documentation available to him, and shall approve or disapprove any proposed alternates. The decision of the Engineer shall, in all cases, be final.

D. The Contractor shall coordinate the installation of all electrical equipment proposed for use in this project with all building trades (architectural, structural, mechanical, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and

construction revisions necessary in his or any other contract or trade that may be required to satisfy the plans and specifications.

E. If substitutions are made in lieu of equipment specified, the manufacturer's literature shall be submitted to the Engineer for approval. In the case of lighting fixtures, full IES photometric test reports for the fixture, lamp(s), and lenses shall be submitted for approval.

1.09 SUBMITTALS

A. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' submittals on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted electronically (e.g. pdfs, etc.) with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review.

1. Submit a listing of all the materials indicated below, with the type of material, manufacturer and catalog or model number for each (where applicable):
   Package #1
   Conductors
   Conduit
   Multiconductor Cables
   Wiring Devices and Plates
   Disconnect Switches
   Time Switches
   Photocells
   Lighting Contactors
2. Submit complete shop drawings of the following when supplied by the electrical contractor:
   Package #2
   Fuses and/or Circuit Breakers
   Short Circuit and Coordination Study
   Switchboards
   Transformers
   Surge Protective Devices
   Motor Control Centers with typical schematic of starters
   Panelboards and Cabinets
   Cable Tray and Tray Fittings
   Busway
   Seismic Restraint
   Package #3
   Lighting Fixtures
   Occupancy Sensors
   Lighting Control Panels

Package #4
Generator Set
Transfer Switch
Package #5
Fire Alarm System
Package #6
Lightning Protection

3. Submit test reports as required in section 3.07 - Electrical Testing.

B. All shop drawing approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to being submitted to the Engineer.

C. Review of shop drawings by the Engineer does not relieve the Contractor from responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements (roof penetrations, wall penetrations, floor penetrations, curbs, electrical, etc.) of all approved equipment with the other trades and disciplines at no additional cost.

D. All shop drawings shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

E. Provide Material Safety Data Sheet (MSDS) or letter from manufacturer certifying the VOC content for each field-applied adhesive, sealant, paint and coating.

F. VOC Content: Submit adhesive and sealants product information or MSDS showing VOC Content information for all applicable products specified under this section. All applicable products in this section must meet low VOC content as specified by LEED Specification Section 01 81 13 Sustainable Design Requirements.

1.10 RENOVATIONS AND ADDITIONS

A. Prior to the ordering or purchasing of any equipment or materials or the layout or installation of any work, the Contractor shall examine the premises and verify any and all of the existing conditions under which he will be obliged to operate, or that will in any manner affect the work under this Contract.

B. Work requiring interruption of electrical power which would adversely affect the normal operation of the other portions of the Owner's property, shall be done at a time other than normal working hours and scheduled in advance with the Owner. Normal working hours shall be considered eight a.m. to five p.m. Monday through Friday. Schedule all outages with the Owner prior to the shutdown.

C. Prior to submitting bids on the project, visit the site of the work to become aware of existing conditions which may affect the cost of the project.

D. Where work under this project requires extension, relocation, reconnection or modifications to existing equipment or systems, the existing equipment or systems shall be restored to their original and operating condition.

E. Extend new homeruns or circuit extensions, where required. Disconnect and remove all equipment indicated to be demolished, including outlets, devices, raceways and conductors.

F. Care shall be exercised in the removal and storage of equipment indicated to be relocated or removed and reused. Prior to placing back into service, equipment shall be cleaned, relamped, and marred or chipped paint surfaces touched-up.

G. Provide all coring, cutting and patching to existing walls, floors, etc., required for the removal of existing work or the installation of new work.

H. All equipment removed in the renovation area is to be removed from the site. No existing pipe or materials are to be removed and reused on the renovation.

1.11 COORDINATION OF TRADES

A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

B. Work shall not be performed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated equipment installed should they interfere with the proper installation and mounting of mechanical equipment, ceilings and other architectural or structural finishes.

C. The Contractor shall coordinate the elevations of all equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.

D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.

E. The Contractor shall confirm that work installed under this section does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.

F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.

1.12 WARRANTY

A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.

B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

1.13 TEMPORARY LIGHT AND POWER

A. The Contractor shall provide a temporary service of the amperage and voltage required by the Project Manager.

B. Sufficient wiring, outlets and lamps shall be installed to ensure proper lighting in accordance with OSHA, state and municipal codes. Refer to Division 1 specifications for requirements.

1.14 EQUIPMENT REQUIRING ELECTRICAL SERVICE

A. Review all specification sections and drawings including mechanical, plumbing and other equipment drawings and other divisions of the specifications for equipment requiring electrical service. Provide service to and make connections to all such equipment requiring electrical service.

B. Prior to installing material such as electrical equipment, devices, feeders, or branch circuits serving equipment of all other trades, the Contractor shall coordinate with the electrical requirements of the equipment to be installed.

1.15 MECHANICAL SYSTEMS COORDINATION

A. All control wiring for mechanical systems shall be installed under Division 23.

B. Motor controllers (starters) shall be furnished under Division 23 and installed under Division 26, unless specified otherwise.

C. Power wiring to all motors and motor controllers and between motors and controllers shall be provided in Division 26.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Contract Documents shall be suitable for the intended use and shall be subject to approval by the Engineer.

B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.

C. All equipment shall bear the inspection label of Underwriters Laboratories Inc.

D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

E. The published standards and requirements of the National Electrical Manufacturers Association, the American National Standard Institute, the Institute of Electrical and Electronic Engineers, and the American Society of Testing Materials, are made a part of these specifications and shall apply wherever applicable.

2.02 IDENTIFICATION

A. Equipment or devices specified in the individual sections to be identified shall be identified by machine cut stencil unless the equipment is identified by the manufacturer. Identification of flush mounted cabinets and panelboards shall be on the inside of the device. Surface mounted equipment shall be identified on the outside cover. Equipment operating on 208Y/120 volt system shall be identified with black labels with white inner core, 480Y/277 volt equipment with red labels with white inner core.

B. All switchboards and panelboards supplied by a feeder shall be stencil-labeled to indicate the equipment where the power supply originates.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Mounting heights, unless otherwise noted, are to be center line of the equipment and/or device except the mounting height of suspended light fixtures which is to the bottom of fixture.

B. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.02 EXCAVATION, TRENCHING & BACKFILLING

A. Contractor shall call underground utilities locator company before digging.

B. Barricades shall be provided around open holes and trenches. Temporary bridges shall be provided over trenches cut through major sidewalk routes. Major sidewalk routes shall not be closed to pedestrian traffic.

C. Barriers shall be provided to protect landscaping adjacent to the excavation area.

D. When rocks, concrete or other debris are encountered during excavation, remove completely.

E. Where sidewalk sections must be removed for installation of underground ducts, remove the sidewalk sections completely from joint to joint.

F. Where asphalt must be removed for installation of underground ducts, saw cut the asphalt in two, straight, parallel lines.

G. Backfill excavations in 6-inch layers and mechanically compact to 98 percent compaction.

H. Excavated materials may be used as backfill only if the backfill is sand or clean dirt that is free of rocks and debris over 3/4" in diameter.

I. In landscaped areas, backfill and mechanically compact to a depth of 6 inches below grade.

J. Backfill the last 6 inches with clean topsoil. Reseed lawn areas.

K. Restore concrete sidewalks and asphalt.

L. The Contractor shall perform all excavation to install the work herein specified and as indicated on drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and other excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. No tunneling shall be done except under pavement.

M. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, and tamped. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.

N. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and tamped until the crown of the pipe is covered by a minimum of 6" of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned. In instances where the manufacturer's installation instructions for materials are more restrictive than those prescribed by the code, the material shall be installed in accordance with the more restrictive requirement. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 98% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off. A metallic lined underground warning tape shall be provided 12" below finished grade. The tape shall be red for electrical lines and orange for telephone and shall be identified as to the type of line.

O. Perform excavation and backfilling work in accordance with applicable portions of the earthwork section.

3.03 STORAGE AND PROTECTION OF MATERIALS

A. Refer to the general requirements section of the specifications, Division 1, for storage, protection, and handling requirements.

B. Inspect materials upon arrival at project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material.

C. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact.

D. Containers which are broken, opened, watermarked, or otherwise damaged materials are unacceptable and shall be removed from premises.

E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials.

Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.04 CONCRETE WORK

A. Construct curbs, pads, vaults and similar supports for electrical equipment where required.

B. Provide 4" thickness housekeeping pads at floor mounted equipment, covering entire area occupied by equipment. Dowel pads to structural slab.

C. Perform concrete work in accordance with applicable portions of Concrete sections. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

3.05 PAINTING

A. Except as otherwise specified, painting shall be accomplished under Painting Section. Surfaces shall be left clean of debris and free from oil and other substances which would prevent paint bond.

B. Touch up finishes of factory painted apparatus where finish is marred during installation.

C. Where galvanizing is broken during fabrication or installation, recoat exposed areas with cold galvanizing compound.

D. Do not paint over nameplates on equipment, nonferrous hardware, accessories or trim.

3.06 WORKMANSHIP

A. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components.

3.07 ELECTRICAL TESTING

A. Furnish all labor, materials, instruments, supplies, and services and bear all costs for the accomplishment of the tests herein specified or requested at job site. Correct all defects appearing under test, and repeat the tests until no defects are disclosed, leave the equipment clean and ready for use.

B. All grounds, crosses, shorts, etc., must be eliminated from the wiring. Test all lighting fixtures, together with switches and controls; test the operation of all motors, controllers, and other electrical equipment devices.

C. The switchboard and all feeders shall be Meggar tested. A copy of all test reports shall be given to the Engineer.

D. The Contractor shall perform any tests other than herein specified which may be required by the Engineer or the authority having jurisdiction.

E. Perform the following tests after installation but before energizing the equipment. The following tests and procedures apply to all equipment and material that is to be tested under this Contract.

1. Transformers
   a. Visually inspect all components for damage, check bushings and insulators for cracks; transformer casing for evidence of leakage; pressure, temperature and liquid level gauges for proper indications.
2. Ground Resistance
   a. Visually inspect for specified ground connections.
   b. Perform ground resistance test at all connections to switchboards and panelboards.
   c. Use three point or fall of potential method.
   d. Verify single point connection (at the counterpoise) between the grounded and grounding systems.
   e. Additional ground rod is required if resistance is greater than 25 ohms.
3. Switchboards and Panelboards
   a. Visually inspect all components for damage.
   b. Check operation of circuit breakers/fusible switches.
4. Ground Fault Systems
   a. Visually inspect for damage and improper connections.
5. Transfer and Other Relay Schemes
   a. Investigate intended function, and verify correct operation.

F. The Engineer shall be notified immediately of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.

G. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, the Contractor shall promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to meet the specified requirements.

3.08 TRAINING

A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner's key personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all equipment and systems. After these sessions

are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all equipment and systems.

END OF SECTION

SECTION 26 05 19

CONDUCTORS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 26 00 00 - Electrical General.

1.02 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install conductors, complete, as indicated on the Drawings and as specified herein. Provide a complete system of wiring with all feeders and branch circuits as shown on the Drawings. The wiring system shall be complete to each and every outlet and apparatus shown on the Drawings which requires electrical connections.

B. This section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts or less.

1.03 COLOR CODING

A. Color coding shall be as follows:

120/208 Volt System	**277/480 Volt System**
Phase A –Black	Phase A - Brown
Phase B – Red	Phase B - Orange
Phase C – Blue	Phase C - Yellow
Neutral – White	Neutral - Gray
Ground – Green	Ground - Green
Isolated Ground - Green with yellow strip (where applicable)	

(Verify color-coding with local code Authority and use local code requirements if and only if the above color code is not acceptable to local authority.)

B. All wire shall be color coded throughout its entire length. Colored phase tape is not allowed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Wire shall be Southwire, General Cable, Encore or approved equal.

2.02 CONDUCTORS

A. Conductor Material: Unless noted otherwise, conductors shall be copper, 99% conductivity except where specifically noted otherwise on Drawings.

B. All wire and cable for feeders and branch circuits shall have copper conductors and shall be 600 volts, 90 degrees C, NEC type conductors with THHN/THWN-2/XHHW-2 insulation.

C. Wire No. 8 AWG and larger shall have stranded conductors. Wire No. 10 AWG and smaller shall be solid conductor type.

D. No conductor shall be smaller than No. 12 AWG unless otherwise specified or noted. [For wiring within dwelling units, No. 14 AWG is allowed for 15-amp circuits, unless prohibited by the authority having jurisdiction.]

E. Branch circuit wiring which supplies more than one fluorescent fixture through the wiring of other fixtures shall be high temperature wire approved for such use.

F. Pulling lubricant is neither required nor allowed for Southwire/SIMpull™ or Encore SuperSlick conductors.

G. Nonmetallic-Sheathed Cable

1. NM cable shall be permitted in one-, two- and multi-family dwellings for building construction types III, IV and V, and where permitted by the local authority.
2. NM cable shall be permitted in other structures of types III, IV, and V construction provided that it is concealed within walls, floors, and/or ceilings that provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.
3. NM cable shall not be installed in areas such as attic spaces within a clubhouse building which do not meet the thermal barrier criteria listed above or in portions of a building defined as assemblies per NEC article 518 with an occupant load of 100 or more people.

2.03 ALUMINUM CONDUCTORS

A. Where substituted for copper conductors, aluminum conductors shall match or exceed copper ampacity.

B. Aluminum conductors shall be compact, AA-8000 series.

C. Aluminum conductors shall not be used for branch circuits, and shall not be installed to any vibrating equipment (e.g. mechanical equipment, transformers, elevators, fire pumps). Minimum rating of feeder size shall be 100 amps.

D. Mechanical screw-type connectors shall comply with the following:

1. Connectors shall be dual rated (AL7CU or AL9CU) and listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.
2. Using a suitable stripping tool, to avoid damage to the conductors, remove insulation from the required length of the conductor.
3. Wire brush the conductor and apply a listed joint compound.
4. Torque all terminations in accordance with the lug manufacturer's recommended torque values. In absence of recommendations, terminate to torque valves per UL 486A-B.
5. Wipe off any excess joint compound.

E. For connection to aluminum bus, the following hardware shall be used:

1. Bolts: Anodized alloy 2024-T4 and conforming to ANSI B18.2.1 and to ASTM B211 or B221 chemical and mechanical property limits.
2. Nuts: Aluminum alloy 6061-T6 or 6262-T9 and conforming to ANSI B18.2.2.
3. Washers: Flat aluminum alloy 2024-T4, Type A plain, standard wide series conforming to ANSI B27.2.
4. Torque all terminations in accordance with the lug manufacturer's recommended torque values. In absence of recommendations, terminate to torque valves per UL 486A-B.

F. For connection to copper bus, the following hardware shall be used:

1. Bolts: Plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to ASTM A-325 or SAE grade 5.
2. Nuts: Heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B.
3. Washers: Should be steel, Type A plain standard wide series conforming to ANSI B27.2.
4. Belleville conical spring washers: shall be of hardened steel, cadmium plated or silicone bronze.

5. Torque all terminations in accordance with the lug manufacturer's recommended torque values. In absence of recommendations, terminate to torque valves per UL 486A-B.

G. Aluminum conductors shall not be used where expressly forbidden by the local electrical inspections department or plan review board of jurisdiction. The electrical contractor shall verify this requirement prior to bid.

H. Aluminum conductors shall not be connected to equipment which is not UL Listed for aluminum.

I. Service entrance cable, Type SE (THHN/THWN-2/XHHW-2), Style SER, 600 volt, aluminum alloy shall be permitted as unit panel feeder in multifamily dwellings.

2.04 METAL CLAD "MC" CABLE

A. Where allowed by the authority having jurisdiction, the use of metal clad cable is permitted as described below and shall meet all the requirements of the following codes and standards:

1. Underwriters Laboratories Inc. 44, 83, 1479, 1569, 1581, 2556
2. National Fire Protection Association NFPA 70, Article 330
3. All local codes and municipal ordinances.

B. The conductors of the metal clad cable shall comply with Articles 1.03 and 2.02 of this same section.

C. Unless noted otherwise on drawings, MC cable shall be limited to branch circuits concealed in walls, above ceilings and within electrical rooms. For MC cable circuits powered from a surface-mounted panelboard, cable homeruns shall be installed to a metal wireway above the panelboard, and conductors (without armor) shall be routed within metal conduit(s) from wireway to panelboard. Ampacity adjustment factors are not necessary for conduit lengths of 24" or less.

D. MC cable shall not be allowed for wiring to mechanical equipment, except for within the dwelling units.

E. Unless noted otherwise, the metal clad cable shall be **MC** with either a galvanized steel jacket or aluminum interlocked armor, a UL 1569 binder tape, with either a green insulated grounding conductor or MCI-A type cable with interlocked armor that is listed and identified for grounding, and rated for a maximum of 600 volts.

F. Where indicated, the metal clad cable shall be a **Jacketed Metal Clad and Parking Deck Cable** with a black or gray PVC covering, using solid copper conductors, a

Mylar assembly covering tape, rated at 90 degrees centigrade, with a green insulated grounding conductor and rated for a maximum of 600 volts.

G. Where indicated, the metal clad cable shall be **MC/IG Isolated** Ground Cable using a galvanized steel jacket (blue with green strip), solid copper conductors, a Mylar assembly covering tape, rated at 90 degrees centigrade, with a green insulated grounding conductor, an extra green with yellow strip insulated grounding conductor and rated for a maximum of 600 volts. Type HCF MC^{AP} cable shall be permitted.

H. MC cable installed to wiring devices or fixed electrical equipment in patient care areas shall have both an insulated grounding conductor and a cable armor listed as a ground path per NEC 517. Type HCF MC^{AP} cable shall be permitted.

I. Refer to National Electrical Code Article 330 for uses not permitted.

J. Cables installed in other than vertical runs through bored or punched holes in wood or metal framing members, or through notches in wooden framing members and protected by a steel plate at least 1/16 inches thick, shall be considered supported and secured where such support does not exceed six (6) feet intervals.

K. Cables containing four or fewer conductors sized not larger than No. 10 AWG shall be secured within 12 inches of every box, cabinet, fitting or other cable termination.

L. Metal clad cable (Type MC), where installed in wet and damp locations, shall be rated for the condition of use and by written authorization from the project Engineer.

2.05 ACCESSORIES

A. Wire Joints: T & B "Sta-Kon," Scotchlok Type "R," Ideal No. 452 or 453, or Buchanan "B-Cap."

B. Cable Connectors: Solderless Type O.Z. "circular clamp type" or T & B "lock-tite" appropriate for the particular application involved.

PART 3 - EXECUTION

3.01 PREPARATION

A. Lubricant: No grease, oil or lubricant other than powdered soapstone or approved pulling compound shall be used to facilitate the pulling of wires. Lubricant shall not be used for conductors with SIMpull^{TM} insulation.

3.02 INSTALLATION

A. Complete electrical systems shall be provided as shown on the Drawings and/or as specified herein.

B. Wires shall be pulled without excessive strain to prevent damage to conductor or insulation. Provide pull boxes as required to facilitate pulling of wire.

C. Prior to energizing, all service and feeder cables shall be tested with megohm meter to determine insulation resistance levels. Test report shall be submitted to the Engineer.

D. Each raceway indicated by symbol on Drawings shall contain three (3) No. 12 AWG wires unless otherwise noted, scheduled or indicated. Hatch marks on raceway symbols indicate the number of conductors in a raceway when the number exceeds three (3).

E. At each fixture or device outlet, a loop or end of wire not less than 6" long shall be left for connection to fixture or device.

F. Splices, taps and connections shall be made up as follows:

1. Wire sizes No. 10 AWG and smaller with wire nuts.
2. Wire and cable of sizes No. 8 AWG and larger, with insulated mechanical or crimped connectors.

G. Perform conductor tests as described in Section 26 00 00 - Electrical General.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work required under this section of the Specifications consists of furnishing, installation and connections of the building grounding system. Exterior branch circuit wiring and feeder conductors extended beyond the building are included. The building electrical system shall be [3-phase, 4-wire] [single-phase, 3-wire] [grounded] [wye] [delta] system supplemented with equipment grounding system. Equipment grounding system shall be established with equipment grounding conductors; the use of metallic raceways for equipment grounding is not acceptable.

1.02 REGULATORY REQUIREMENTS

A. Install a complete grounding system in accordance with the National Electrical Code.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide all materials under this section of the specifications.

B. All materials shall be new, UL Listed, and bear a UL Label.

C. Refer to Section 26 05 19 - Conductors for conductor specification.

2.02 GROUNDING CONDUCTORS

A. Grounding electrode conductor shall be bare or green insulated copper conductor sized as indicated on the Drawings.

B. Equipment grounding conductors shall be green insulated conductors sized as indicated on the Drawings. Where size is not indicated on the Drawings, conductor size shall be determined from the National Electrical Code table on sizes of equipment grounding conductors.

C. Bonding jumpers shall be flexible copper bonding jumpers sized in accordance with the National Electrical Code tables for grounding electrode conductors.

2.03 PANELBOARDS, TRANSFORMERS, AND DISCONNECT SWITCHES

A. Provide each low voltage distribution and branch circuit panelboard with a copper equipment grounding bar brazed or riveted to the associated enclosures or cabinet and an insulated neutral bar.

B. Provide a conductor termination grounding lug bonded to the enclosure of each equipment item.

2.04 DEVICES

A. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame.

2.05 GROUND RODS

A. Ground rods shall be 3/4" x 10'-0" copper clad steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ground all non-current carrying parts of the electrical system including raceways, equipment frames and enclosures, outlet boxes, junction boxes, and other conductive material in close proximity with electrical circuits.

B. Service entrance and separately derived electrical systems, grounding electrode system

1. The grounded conductor(s) of the electrical service serving the premises wiring system shall be connected to the neutral bus bar in the service equipment which shall be grounded to the cold water system, the ground rod system, and other grounding electrodes specified herein or indicated on the Drawings. Grounding electrode conductors shall be installed rigid, nonmetallic conduit to point of ground connection, unless subject to physical damage in which case it shall be installed in galvanized rigid steel.
2. Make connection to main water line entering the building. Make connections ahead of any valve or fittings whose removal may interrupt ground continuity.
3. Bond together the following systems to form the grounding electrode system. All system connections shall be made to the electrodes as close as possible to the service entrance equipment and each connected at the service entrance equipment neutral bus. Do not connect electrode systems together except at neutral bus.
   a. Cold water piping system

b. Ground rod system
c. Rebar in concrete footing
d. Structural steel metal building frame
e. Lightning protection system

4. Ground the neutral of all dry type transformers to either building steel or a common grounding electrode conductor connected to a service ground. Transformers shall be bonded to the nearest available point on the interior water piping system. In reinforced concrete structures building steel shall be considered to be reinforcing steel of vertical columns.
5. Grounding electrode connections to structural steel, reinforcing bars, ground rods, or where indicated on the Drawings shall be with chemical exothermic weld connection devices recommended for the particular connection type. Connections to piping shall be with UL Listed mechanical ground clamps.
6. Where there is more than one service to a building or interconnected buildings, services shall be connected by means of a grounding electrode conductor.
7. Bonding shall be in accordance with the National Electrical Code.
8. Install ground rods where indicated on the Drawings with the top of the ground rods 12 inches below finished grade.
9. Ground the neutral and frame of the emergency generator to building steel and the main electrical service ground rod system. In reinforced concrete structures building steel shall be considered to be reinforcing steel or vertical columns. Make connection to building steel with chemical weld type connector, in a location in unfinished space where the connection will not be subject to physical abuse.
10. Generator ground and neutral connections shall be bonded together.

C. Equipment Grounding Conductor

1. Grounding conductors for branch circuits are not shown on the Drawings; however, grounding conductors shall be provided in all branch circuit raceways and cables.
2. Grounding conductors for feeders are typically indicated on the Drawings and the raceway is sized to accommodate grounding conductor shown. Where grounding conductor size is not indicated on the Drawings, conductor shall be in accordance with the equipment grounding conductor table of the National Electrical Code.

D. Other Grounding Requirements

1. Each telephone backboard shall be provided with a No. 6 grounding conductor. When backboard is located in vicinity of electrical service equipment, the “point of grounding” of this conductor shall be the main cold water service with connections made ahead of any valves or joints.

Remote backboards shall use building steel as "point of ground." Terminate conductor by stapling to backboard.

2. At each building expansion joint flexible copper bonding jumpers shall be attached to building structure by chemical weld process. Install bonding jumpers in concealed locations that will not subject connections or jumpers to physical abuse. Install 100' on centers across expansion joints.

3.02 TESTING

A. Upon completion of the ground rod installation, the Contractor shall test the installation in accordance with the "Electrical Testing" section of Section 26 00 00 - Electrical General. Grounding resistance reading shall be taken before connection is made to the building cold water piping system. Ground resistance readings shall not be taken within 48 hours of rainfall.

END OF SECTION

SECTION 26 05 30

FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 26 shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Firestopping for Electrical Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Typical firestopping installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful Contractor shall meet or exceed all requirements described in this document.

1.02 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install all Firestopping Materials.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Firestopping manufacturer(s)

1. FlameStopper Thru-Wall Fitting - Wiremold Company (Firestop Devices)
2. Tremco Inc. (Firestop Cast in Place Sleeves, Caulks, QuickComm Sleeves, QuickComm Units, Pillows, Putty Pads, Outlet Box Inserts, Silicone, Composite Sheets, Collars, Devices)
3. STI Firestop Products (Firestop Devices, Putties, Caulks, Sealants, etc.)
4. Hilti (Putties, Caulks, Sealants, etc.)

2.02 TYPES OF PRODUCTS

A. Firestop Products

1. Intumescent Firestop Sealants and Caulks
2. Acrylic Firestop Sealant and Caulks
3. Silicone Firestop Sealants and Caulks
4. Cast in Place Devices
5. Firestop Putty, Putty Pads
6. Outlet Box Inserts
7. QuickComm Sleeves
8. TREMstop Straps
9. Firestop Collars
10. Wrap Strips
11. Firestop Mortar
12. Firestop Pillows
13. Accessories: Forming/Damming Materials: Mineral Wool, Backer Rod or other type as per manufacturer recommendation.

B. Firestop Devices

1. Thru-Wall Fitting (FlameStopper by Wiremold)
   a. The firestop device box shall be constructed of 16-gauge G90 steel.
   b. The firestop device intumescent block shall be constructed of a graphite base material with expansion starting at 375 degrees F and an unrestrained expansion between 6 to 12 times. The intumescent block shall be held securely by the box in order to prevent tampering and damage during installation.
   c. The firestop device shall have doors which can be adjusted to prevent materials from penetrating the device if the device is empty or completely full. The doors shall be constructed of 16-gauge G90 steel with No. 10-32 screws use to adjust opening size.
   d. The firestop device shall be available for 2" and 4" trade size EMT conduit.
   e. The firestop device shall be available in safety yellow powder coat, custom colors and an unpainted galvanized finish.
2. Fire Rated Cable Pathway (STI EZ-PATH)
   a. Fire rated cable pathway device modules shall be comprised of steel raceway with intumescent foam pads allowing 0 - 100% cable fill.
3. Tremco (QuickComm Unit) 24" x 12" or 34" x 18"
   a. Fire rated steel frame with an intumescent channel. UL Tested for large openings with 100% visual cable fill. UL Tested for Concrete Floors, Block Walls, Dry Walls and Hollow Core Floors.

4. Tremco (QuickComm Sleeve)
    a. Fire rated steel sleeve with an intumescent inner sleeve. UL Tested for Concrete Floors, Block Walls, Dry Walls, Hollow Core and Fluted Decks.

2.03 UL CLASSIFICATION

A. Thru-Wall Fitting: The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814 & ASTM E 84).

B. Threaded, Smooth and Split-Sleeve Firestop Devices: Firestopping sealants and devices shall be used together as a firestop system. All firestop systems shall bear a UL Classification system number.

C. QuickComm Sleeve: Firestop Sleeve for use in through penetration firestop systems. Shall be tested by Underwriters Laboratories Inc. or a recognized Testing Laboratory for through penetration fire stopping applications.

D. QuickComm Unit: Intumescent Firestopping Unit for use in large openings for firestopping for cables, Fiber optic, Power Control, Telecommunications

1. Threaded Firestop System
    a. Block Wall - W-J-3049
    b. Dry Wall - W-L-3138
2. Threaded Firestop System (Vertical)
    a. Slab - F-A-3010
3. Smooth Firestop System
    a. Block Wall - W-J-3048
    b. Dry Wall - W-L-3137
4. Split-Sleeve Firestop System
    a. Block Wall - W-J-3047
    b. Dry Wall - W-L-3136
5. Tremco QuickComm Sleeve
    a. Block Wall- C-AJ-0123, C-AJ-2580, C-AJ-3270
    b. Dry Wall- WL-0025, WL-2418, WL-3318
    c. Concrete Floor- C-AJ-0123, C-AJ-2580, C-AJ-3270
    d. Fluted Deck- C-AJ-0123
    e. Hollow Core- C-AJ-0123, C-AJ-2580, C-AJ-3318
6. Tremco QuickComm Unit
    a. Dry Wall- WL-3319, WL-4070
    b. Concrete Floor- F-A-3035, F-A-4006

2.04 FIRESTOPPING SYSTEMS

A. Thru-Wall Fitting Firestop System

1. The device shall be classified for use in one-, two-, three-, and four-hour rated gypsum, concrete and block walls and provide an L rating of less than 5 cfm. The device shall also be tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

B. Threaded, Smooth and Split-Sleeve Firestop Systems

1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 and ASTM E 84 (UL 1479) fire tests in a configuration that is representative of field conditions.
2. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

C. Firestopping materials and systems must be capable of closing or filling through-openings created by the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials.

D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

E. Firestopping sealants must be flexible, allowing for normal pipe movement.

F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

H. Firestopping material shall be installed inside the cavity of the wall as shown by the annular space requirements in the UL Tested System.

PART 3 - EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

A. General

1. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.

B. Through-Penetrations

1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations

1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet ASTM E 814 and ASTM E 84 Test requirements.

D. Smoke-Stopping

1. As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved for the ASTM E 136 Standards.

3.02 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Verify that environmental conditions are safe and suitable for installation of firestop products.

C. Verify that all pipes, conduit, cable, and other items that penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.03 INSTALLATION

A. General

1. Through Penetration firestop submittals showing each UL Rated Assembly shall be located in the general Contractor's trailer for Inspection purposes.
2. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Written documentation stating training done on the specific project shall be supplied to the General Contractor for inspection purposes. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
3. Apply firestops in accordance with UL Tested Systems, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
4. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
5. Seal holes and penetrations to ensure an effective smoke seal. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
    a. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
    b. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.

B. Dam Construction

1. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

3.04 FIELD QUALITY CONTROL

A. Preconstruction meeting shall take place to address firestopping systems to be installed.

B. Prepare and install firestopping systems in accordance with UL Tested System and manufacturer's printed instructions and recommendations.

C. Follow safety procedures recommended in the Material Safety Data Sheets.

D. Finish surfaces of firestopping that are to remain exposed in the completed work to a uniform and level condition.

E. All areas of work must be accessible until inspection by the applicable Code Authorities.

F. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification.

3.05 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.

B. Leave finished work in a neat and clean condition with no evidence of spillovers or damage to adjacent surfaces.

END OF SECTION

SECTION 26 05 33

CONDUIT AND RACEWAYS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This section covers the complete interior and exterior conduit system.

B. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 26 00 00 - Electrical General.

1.02 STANDARDS

A. Industry Standards

1. Underwriters Laboratories Inc. (UL) Publications
   - No. 1: Standard for Flexible Metal Conduit
   - No. 6: Standard for Rigid Metal Conduit
   - No. 467: Standard for Grounding and Bonding Equipment
   - No. 651: Standard for Schedule 40 and 80 Rigid PVC Conduit
   - No. 797: Electrical Metallic Tubing - Steel
   - No. 1242: Standard for Electrical Intermediate Metal Conduit - Steel
2. American National Standards Institute (ANSI)
   - C-80.1: Rigid Galvanized Conduit
   - C-80.3: Electrical Metallic Tubing

1.03 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install conduits and raceways, complete, as indicated on the Drawings and as specified herein.

B. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers

1. Metallic Conduit Fittings
   a. Thomas and Betts
   b. Appleton
   c. RACO
   d. Crouse Hinds
   e. Steel City
2. Support Channel
   a. Unistrut
   b. Kindorf
3. Non-metallic Conduit Fittings
   a. Carlon
   b. Georgia Pipe Company
4. Rigid, IMC or Flexible Conduit
   a. Allied
   b. Republic
   c. Triangle
   d. Wheatland
   e. Youngstown
   f. Southwire
5. Flexible Conduit (PVC Conduit)
   a. Anaconda “Sealtite”
   b. Robroy
   c. Southwire
6. Electrical Metallic Tubing
   a. Steeltubes
   b. National
   c. Wheatland
   d. Allied
   e. Triangle
   f. Youngstown
7. Plastic PVC
   a. Carlon
   b. Georgia Pipe Company
8. Pull Box Manufacturer(s)
   a. Hoffman
   b. OZ Gedney
   c. Or Approved Equal
9. Approved Marker Tape Manufacturer(s)
   a. William Frick & Associates
   b. Or Approved Equal

10. Approved Maintenance Hole/Handhole Manufacturer(s)
    a. Old Castle
    b. Pencell (Handholes Only)
    c. Quazite (Handholes Only)
    d. Or Approved Equal
11. Approved Conduit Plug/Cap Manufacturer(s)
    a. Jack Moon
    b. Or Approved Equal

2.02 CONDUIT FITTINGS

A. Electrical metallic tubing (EMT) couplings and connectors shall be steel. Malleable iron, pressure cast or die cast fittings are not permitted.

B. Fittings and couplings shall be set-screw type and/or compression type per 3.01 13. Steel set screw type for 2.5" conduit and larger shall have 2 screws for connectors and 4 screws for couplings. All connectors shall be insulated throat type.

C. Rigid steel and IMC couplings and connectors shall be standard threaded couplings, locknuts, bushings and elbows. All materials shall be steel. Erickson-type couplings may be used to complete a conduit run.

2.03 NON-METALLIC CONDUIT AND FITTINGS

A. Non-metallic conduit shall be heavy wall, Schedule 40 PVC. Electrical non-metallic tubing (ENT) shall be allowed within dwelling units.

B. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

C. PVC conduit for concrete encasement shall be Type DB, UL Labeled for 90 degrees C cables. Fittings shall be Type DB, solvent type, and from the same manufacturer as the conduit.

D. Concrete shall have a minimum strength of 2,500 psi at 28 days.

2.04 CONDUIT SUPPORT

A. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose and sized appropriately for the conduit type and diameter. Support individual conduits 1-1/2" and smaller with 1/4" threaded steel rods and use 3/8" rods for 2" and larger.

B. Conduit support channels shall be 14-gauge galvanized (or equivalent treatment) channel sized for the amount of conduit to be supported. Channel suspension

shall be 3/8" threaded steel rods. Conduit straps shall be spring steel type compatible with channel.

C. Conduit straps shall be single-hole cast metal type or two-hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

2.05 RIGID METALLIC CONDUIT, INTERMEDIATE METALLIC CONDUIT, AND ELECTRICAL METALLIC TUBING

A. Rigid metallic conduit and intermediate metallic conduit shall be steel and standard thread.

B. Electrical metallic tubing (EMT) shall be steel.

2.06 RIGID METALLIC, INTERMEDIATE METALLIC, AND FLEXIBLE CONDUIT AND FITTINGS

A. Rigid metallic conduit and intermediate metallic conduit shall be steel and standard thread.

B. Flexible conduit shall be steel or aluminum type classified for system grounding.

C. Connectors for flexible conduit shall be insulated throat type rated as suitable for system ground continuity.

D. Flexible conduit used for other than connections to lighting fixtures shall not be less than 1/2" trade size. 3/8" flexible conduit may be used for connection to lighting fixtures when sized according to the National Electrical Code.

E. Flexible conduit used in damp or wet locations shall be liquid tight.

2.07 PULL BOXES

A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.

B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.

C. Pull boxes shall have provisions for grounding.

2.08 MAINTENANCE HOLES/HANDHOLES

A. Maintenance Holes

1. Maintenance holes shall be pre-cast or cast-in-place concrete with a strength of 3,500 psi at 28 days, and steel reinforced.
2. Maintenance holes shall include a cast iron frame with cover, a hot dipped galvanized steel ladder, and hot dipped galvanized pulling eyes embedded in the concrete opposite each duct entrance and in the floor beneath the cover.
3. Maintenance holes shall be equipped with grounding busbar.
4. Maintenance holes shall be equipped with racking for cable storage.
5. Ground splices and connections at maintenance holes shall be exothermic welds, copper or bronze compression ground fittings, or bolted compression ring lugs.
6. The cover for electrical maintenance holes shall have the lettering, "POWER" or "ELECTRIC."
7. The cover for low voltage maintenance holes shall have the lettering, "COMMUNICATIONS."

B. Handholes

1. Handholes shall be non-conductive and shall not require grounding for safety. Handholes shall be unaffected by freeze/thaw and resistant to sunlight and chemicals. Handholes shall be pre-cast polymer concrete, heavy duty rated and bottomless.
2. Handholes shall be equipped with racking for cable storage.
3. Electrical handholes shall have the word "POWER" or "ELECTRIC" molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.
4. Low voltage handholes shall have the word "COMMUNICATIONS" molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.
5. Handholes shall be able to withstand 10,000 lbs minimum.
6. See Drawings for handhole dimensions and locations.

2.09 CONDUIT PLUGS/CAPS

A. Conduit Plugs/Caps

1. Conduit plugs shall provide a watertight seal at exposed ends of conduits.
2. Conduit plugs shall be conduit size specific.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Minimum size for electrical conduits shall be 1/2" trade size.
2. Minimum size for low voltage conduits shall be 3/4" trade size.
3. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the drawings.
4. Leave all empty conduits with a 200 pound test nylon cord pull line.
5. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
6. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.
7. Protect conduits against dirt, plaster, and foreign debris with conduit caps or plugs, which shall remain in place until all masonry is complete. Protect conduit stub-ups during construction from damage; any damaged conduits shall not be used and are to be replaced.
8. All feeder conduits shall be cleared of any dirt, foreign debris, etc.
9. Install conduit with wiring, including homeruns as indicated on the drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a Contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.
10. Conduits which penetrate roof membranes shall be installed in accordance with manufacturer's recommendations and architectural specifications.
11. Seal all conduits entering building from below grade, all conduits entering refrigerated spaces i.e. freezers and coolers, and all conduits entering exterior mounted electrical equipment with insulating electrical putty to prevent entrance of moisture.
12. Separate raceway systems are to be installed for power systems and for control, signal and communications systems. Do not install control, signal or communications cables in the same raceways as branch circuit or feeders cables, unless indicated otherwise on the drawings.
13. Conduit fittings shall be set screw type for dry, indoor environments. Conduit fittings shall be gland and ring compression type for all conduit exposed to outdoor environments or wet locations.
14. Conduit shall be run parallel or at right angles to walls, ceilings, and structural members.
15. Support conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, fitting, panelboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be

suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

16. Attach feeder conduits larger than one inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.
17. Where conduits must pass through structural members obtain approval of Architect.
18. Install all conduits or sleeves penetrating or routed within rated fire walls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
19. Provide expansion and deflection coupling where conduit passes over a building expansion joint.
20. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
21. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.
22. Telephone and signal system raceways: 2" trade size and smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
23. Conduit shall be installed for feeders on the supply side of any panelboard(s) supplying branch circuits for pools, spas or hot tubs.
24. In inmate accessible areas
    a. Do not install exposed conduit system unless specifically indicated on the drawings.
    b. Where exposed conduit is indicated on the drawings, all conduits shall be rigid metallic type and all outlet boxes shall be cast metal type with threaded hubs.
    c. Install conduits flat against wall; offsets or “kicks” shall be permitted only to enter outlet box.
    d. Support conduits on centers not exceeding 5'-0" and within 12" of each outlet box using two-hole conduit straps attached to surface with non-removable break off security type bolts.
    e. Compression couplings and fittings shall be used for work within walls which are grout-filled.

B. Uses Permitted

1. Conduits installed within concrete floor slabs shall be galvanized rigid steel (GRS), intermediate metal conduit (IMC), Schedule 40, heavy wall PVC, or electrical non-metallic tubing (ENT).
2. Conduit run exterior exposed: Galvanized rigid steel (GRS) or intermediate metal conduit (IMC).
3. Conduits in direct contact with earth shall be Schedule 40, heavy wall PVC. Elbows for underground conduits greater than 200' in length shall be galvanized rigid steel (GRS), or electrical metallic tubing (EMT) if elbows are concrete encased. Service entrance conduits installed exposed, or concealed in walls or above ceilings, shall be galvanized rigid steel (GRS) or intermediate metal conduit (IMC). Unless indicated otherwise, service entrance conduits shall be installed "outside" of the building as defined by the NEC. Provide concrete encasement where required or as indicated on drawings.
4. All other conduit, unless specified herein, not permitted in accordance with the NEC, or otherwise indicated on the drawings, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete or below grade. Feeder or branch circuit conduits that emerge from a floor slab in an exposed location shall be galvanized rigid steel (GRS), electrical metallic tubing (EMT) or intermediate metal conduit (IMC). Where conduits emerge from a floor slab in a concealed location (a wall cavity or above ceiling), PVC elbows are permitted, provided that a conduit adaptor for steel conduit is installed at the nearest point at the slab.
5. Use flexible conduit for connections to motors, [dry type transformers,] [electrical duct heaters,] [unit heaters,] [bus duct tap devices,] [kitchen equipment,] [laundry equipment,] flush mounted lighting fixtures, and any vibrating equipment.
    a. Flexible conduit used for connection of motors, dry type transformers, electric duct heaters, unit heaters, and bus duct tap devices shall not exceed 36 inches in length.
    b. Flexible conduit from outlet box to flush mounted lighting fixture shall not exceed 6 feet in length.
    c. Maintain ground continuity through flexible conduit with green equipment grounding conductor; do not use flexible conduit for ground continuity.
    d. Flexible conduit installed within plenum spaces shall be limited to lengths not exceeding 4 feet.
    e. Liquid tight flexible conduit shall be used to connect equipment in exterior, damp or wet locations.
6. All conduit from the fire pump controller to the fire pump shall be either galvanized rigid steel (GRS) or liquid tight flexible conduit.

C. Below Grade Raceway Installations

1. Install top of conduits 2 inches minimum below bottom of building slabs.

D. Raceway Installations within Concrete

1. Conduit shall be run following the most direct route between points.
2. Conduit shall not be installed in concrete where the outside diameter is larger than 1/3 of the slab thickness.
3. Conduits shall not be installed within shear walls unless specifically indicated on the drawings. Conduit shall not be run directly below and parallel with load bearing walls.
4. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
5. Provide expansion fittings in all conduits that pass through building expansion joints.

3.02 PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.

B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.

C. Pull boxes shall be free from burrs, dirt and debris.

3.03 MAINTENANCE HOLES/HANDHOLES

A. Maintenance holes/handholes shall be installed on a base of pea gravel at least 12 inches deep.

B. Tops of maintenance holes/handholes shall be level with the existing grade.

C. Ducts should enter as perpendicular to the wall surface as possible.

D. Maintenance holes shall be grounded with four 3/4 inch diameter by 8 foot long ground rods, one driven inside of the maintenance hole at each corner. Connect the ground rods and any duct bank ground conductors together with a No. 4/0 AWG bare, stranded copper ground wire loop. A No. 2 AWG bare stranded copper pigtail from the ground wire loop shall be used to ground the maintenance hole cover frame, ladder support bracket, any metallic concrete inserts and metallic cable racks, and the shields of any cables that are spliced in the maintenance hole.

3.04 CONDUIT PLUGS/CAPS

A. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until ready for use.

B. Simplex, triplex or quadplex duct plugs shall be installed in conduits to house and seal cables.

3.05 ADDITIONAL REQUIREMENTS FOR INTERIOR LOW VOLTAGE CONDUITS

A. Conduit runs shall not have more than two (2) 90-degree bends between pull points.

B. Communications conduit system shall contain no condulets (also known as an LB).

C. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) shall be used for entrance conduits that exceed 50 feet into the building.

D. Horizontal Conduits

1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.
2. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.
3. Each horizontal home-run conduit can serve from one (1) to three (3) outlet boxes. For one (1) outlet box, a 3/4" conduit shall be used, minimum. For two (2) outlet boxes, a 1" conduit shall be used, minimum. For three (3) outlet boxes, a 1-1/4" conduit shall be used, minimum.

3.06 REQUIREMENTS FOR OUTSIDE PLANT LOW VOLTAGE CONDUITS

A. Duct Banks

1. Duct banks shall be sloped downward toward maintenance holes/handholes and away from buildings a minimum of 6 inches per 100 feet. Duct banks shall not route water from maintenance holes/handholes

into buildings. Duct banks shall not contain traps between maintenance holes/handholes where water may accumulate.

2. Where power and communications duct banks run in parallel, they shall be separated by a minimum of 12 inches.
3. Where duct banks enter maintenance holes or buildings, they shall be constructed as integral to the wall.
4. Duct bank shall extend to the inside surfaces of the walls, and the duct bank reinforcing shall be integrated with the wall reinforcing.
5. Bell ends shall be provided on ducts where the ducts enter maintenance holes or buildings.
6. Direct buried ducts and fittings shall have bend radii greater than the minimum bend radii of the cables enclosed, and shall not be smaller than the radii of standard manufactured elbows.
7. Direct buried ducts shall be installed parallel to or at right angles to building lines and site features, and as close to curbs and sidewalks as possible to avoid interferences with future landscaping.
8. Where direct buried PVC ducts cannot be buried deep enough to meet the NEC minimum cover requirements, rigid steel conduits shall be installed instead, or a concrete cover shall be poured over the ducts.
9. An orange detectable marker tape (for communications) shall be buried in the backfill approximately 12 inches above duct banks or direct buried cables for the entire length of the duct run.
10. A flexible mandrel and a stiff bristled brush shall be pulled through the ducts to clean them prior to cable pulling.
11. Ducts shall be identified in the maintenance holes and at both ends.

B. Additional OSP Conduit Requirements

1. Install a #14 AWG tracer wire in one conduit for the entire length of each duct run.
2. Below Grade Conduit Installations
   a. Install top of conduits 24 inches minimum below finished grade or as indicated on Drawings.
   b. Install top of conduits 6 inches minimum below bottom of building slabs.
3. For runs that total more than 400 feet in length, insert handholes/maintenance holes so that no segment exceeds the 400 feet limit.

END OF SECTION

SECTION 26 05 34

OUTLET BOXES AND JUNCTION BOXES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 26 00 00 - Electrical General.

1.02 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install outlet and junction boxes, complete, as indicated on the Drawings and as specified herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made the Contractor shall be responsible for the costs of any item and engineered and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.03 QUALITY ASSURANCE

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

1.04 JOB CONDITIONS

A. Protection: Anchor boxes securely to formwork. Provide necessary protection to prevent entry of concrete.

B. Sequencing, Scheduling: Locations of outlets shown on the Drawings are relative and approximate. Exact locations shall be determined on the job and the outlets accurately set according to the architectural drawings, dimensions, casework kneespace, building conditions, furniture positions and Architect's direction. The right is reserved to change the exact location (10'-0" or less) of any switch, ceiling outlet or other outlet in any room before it is permanently installed without increase in Contract cost.

C. All outlet boxes and junction boxes shall be accessible. Any boxes in non-accessible areas (furred ceilings) shall be set flush with barrier surface at a location approved by the Architect.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: National Electric Products Company, Thomas & Betts/Steel City, Appleton or Raco.

B. Acceptable Manufacturers: Thomas & Betts/Steel City, Pass & Seymour or equal.

2.02 OUTLET BOXES

A. Standard Outlet Boxes: Boxes and covers shall be galvanized steel not less than 1/16" thick and in every instance, of such form and dimensions as to be adapted to its specific use and location, kind of fixtures to be used and number, size and arrangement of conduits connecting thereto and particularly sized to accommodate the number and size of wires to be contained therein.

B. Standard Outlet Boxes: Boxes and covers shall be thermo plastic or phenolic and rated according to the space it occupies, of such form and dimensions as to be adapted to its specific use and location, kind of fixtures to be used and number, size and arrangement of conduits connecting thereto and particularly sized to accommodate the number and size of wires to be contained therein.

C. Ceiling outlet boxes shall be 1-1/2" or 3-3/8" deep, 4" octagonal (or 4" square when required due to number of wires). Plaster rings or device covers need not be provided on ceiling boxes. Provide extension rings on ceiling boxes to accommodate number of conductors in box.

D. Wall outlet boxes for toggle switches and convenience outlets shall be 1-1/2" or 2-1/8" deep, 4" or 4-11/16" square. Provide with single-device covers (or two-device covers where needed). Covers shall be raised type to compensate for thickness of plaster or gypsum board wall finish.

E. Outlet boxes for telecommunication purposes (telephone, data, etc.) shall be 4" x 4" square, 2-1/8" deep. Provide with single device covers (or two-device covers where needed). Covers shall be raised type to compensate for thickness of plaster or gypsum board wall finish.

F. Junction boxes shall be as specified for ceiling and wall outlet boxes. Provide flat covers on ceiling outlets to match ceiling finish. Provide blank device type coverplates on wall outlets, of same materials as specified for device coverplates in same room or area.

G. Outlet boxes where exposed rigid conduit is used shall be cast ferrous alloy, galvanized or cast aluminum.

H. Covers: Where outlet boxes are to be capped, blank coverplates shall be used.

I. Barriers: Provide barriers between devices operating at different voltages or on separate systems such as normal, critical, or life safety.

2.03 FLOOR BOXES

A. Product Description

1. Floor boxes for receptacles and telephone/data outlets shall be [rectangular] [round]. Boxes shall include a non-metallic concrete cover to prohibit concrete or debris from entering the box during installation.
2. Floor boxes for use in slab on grade installations shall be non-metallic PVC and be suitable for use in slab on grade conditions.
3. Floor boxes for use in above grade installations shall be metallic and suitable for use in concrete slabs above grade.
4. Provide number of compartments as indicated on drawings.
5. Coverplates and flanges shall be brass.
6. Floor box device covers shall meet UL 514C requirements for scrubwater test standards.

B. Manufacturer

1.	Hubbell	PFBRG Series (Non-Metallic) B243 Series (Metallic)
2.	Walker/Wiremold	880MP Series (Non-Metallic) 880S3 (Metallic)

C. Manufacturer

1.	Hubbell	RF400 Series (Non-Metallic) B252 Series (Metallic)
2.	Wiremold	862 Series (Non-Metallic) 885 Series (Metallic)
3.	Thomas & Betts	68P Series (Non-Metallic)

D. For poke-thru devices, refer to 2.04 D of Section 26 27 26 - Wiring Devices.

2.04 PULL AND JUNCTION BOXES

A. Pull and Junction boxes are not completely indicated. They shall be sized and installed where required in accordance with the NEC.

B. Pull and Junction boxes shall be the suitable NEMA type number to match the environmental conditions.

C. Locations of concealed pull and junction boxes shall be indicated on the record as built drawings for Owner's record.

2.05 CABINETS, FITTINGS, BOXES: GENERAL

A. Cabinets shall be in accordance with UL 50, "Electrical Cabinets and Boxes" and NEMA 250, Type 1. Electrical cabinets, boxes and fittings shall be as required for types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

B. Construction shall be sheet steel, NEMA 1 class except as otherwise indicated. Cabinets shall consist of a box and a front consisting of a 1-piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24" apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24" apart and not over 6" from top and bottom of door. For flush cabinets, make the front approximately 3/4" larger than the box all around. For surface mounted cabinets make from same height and width as box. Furnish metal barriers to separate wiring of different

systems and voltage, and furnish accessory feet where required for freestanding equipment.

C. Fasteners for general use shall be corrosion resistant screws and hardware including cadmium and zinc plated items.

D. Fasteners for damp and wet locations shall be stainless steel screws and hardware.

E. Exterior finish shall be gray baked enamel for items exposed in finished locations except as otherwise indicated.

F. Painted interior finish, where indicated, shall be white baked enamel.

G. Fittings for boxes, cabinets, and enclosures shall be in accordance with UL 5148 and shall be zinc plated steel for conduit hubs, bushings and box connectors.

2.06 UNDERGROUND PULL/JUNCTION BOXES

A. Unless noted otherwise, underground enclosures shall be fiberglass, open-bottom and sloped-wall. Covers shall be polymer concrete. Boxes shall be installed in areas expected to experience only light incidental, non-deliberate vehicular traffic (including that from mowers).

B. Enclosures shall meet the load requirements and three-point test procedures specified in the industry standard ANSI SCTE 77 2007. Enclosures shall meet the Tier 8 cover load test (for light traffic) of 12,000 lbs. over a 10" x 10" plate.

C. Manufacturer’s guidelines shall be followed for installation, including 6" gravel bed beneath box for stability and drainage. Concrete collar shall be poured around enclosure to protect the ring and top from impact due to soil erosion.

D. Manufacturer

1. Highline Products
2. OZ-Gedney

PART 3 - EXECUTION

3.01 INSPECTION

A. The location of all wall outlets, including light fixtures, receptacles, switches, etc., shall be checked to see that the outlet will clear any wall fixture, shelving, work tables, sinks, baseboard and fin type convectors, bulletin boards, etc., that will be installed.

B. Exact locations of outlet boxes shall be coordinated with other trades so that outlet will not be covered by ductwork, piping, etc.

C. The approximate locations of outlets are indicated on the Drawings. The exact locations shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

3.02 PREPARATION

A. Architectural Placement: Outlets occurring in architectural features shall be accurately centered in same. Space wall switch outlets equidistant from door trims on the strike side of doors as actually installed so that coverplate clears trim. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on architectural elevations.

B. Install all outlet boxes in finished areas flush with wall or ceiling finish. Maintain 1/4" or less space between outlet box front and finish wall surface.

C. All switches at same level shall be installed on one horizontal line as shown on the Drawings.

D. Wall mounted controls, including temperature controls, in a room shall be grouped at the same location and at same mounting heights.

3.03 INSTALLATION

A. At all concealed outlets for electric lights, switches, wall receptacles, etc., standard outlet boxes and plaster rings shall be provided.

B. Outlet boxes shall be firmly anchored in place and shall be provided with approved fixture studs where required. Outlet boxes shall not depend on the coverplate to hold it secure to the wall.

C. Boxes on opposite sides of walls or partitions: Where drawings show back-to-back wiring devices, the devices on opposite sides of the wall shall be offset a minimum of 6". Through-the-wall type boxes shall not be used. Where boxes will be located on opposite sides of walls or partitions located 24" or closer to each other, moldable putty pads shall be installed to completely cover the exterior surfaces of the box within the stud cavity with a ball of putty material used to plug the end of each conduit at its connection to the box.

D. All holes cut through new or existing smoke or fire partitions shall be sealed. Sealant shall be 3M Brand Fire Barrier System or approved equal. Seals shall be installed in accordance with manufacturer’s recommendations.

E. All flush boxes in rated walls that are larger than 16 square inches in area shall be backed as follows: 1-hour wall - 1 layer of 5/8" gypsum board; 2-hour rated wall - 2 layers of 5/8" gypsum board. Gypsum shall be fire code and attached to outside surfaces of box(es).

F. Cast aluminum, threaded hub type boxes with gasketed weatherproof covers shall be used for wet locations where box is surface mounted.

G. Location of floor boxes indicated is approximate. The Contractor shall refer to the final furniture layout or request field instructions for the exact location. Consult the Architect prior to installation.

H. For outlet and junction boxes installed within grout-filled walls, boxes shall be sealed externally with duct tape to prevent entry of concrete into boxes.

END OF SECTION

SECTION 26 05 35

LOW VOLTAGE BACKBOARDS & ENCLOSURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Section 26 00 00 - Electrical General shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to backboards.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and/or on the Drawings.

1.02 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

B. The work shall include, but not be limited to, the following:

1. Furnish and install all backboards.
2. Furnish and install all structured media enclosures.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Backboard Manufacturer(s)

1. Hoover – ¾" Pyro-Guard
2. Standard ¾" Plywood (treated with fire-retardant paint)

B. Approved Structured Media Enclosure Manufacturer(s)

1. Leviton
2. Uniprise
3. Hubbell

2.02 STRUCTURED MEDIA ENCLOSURE

A. The structured media enclosure shall be a one-piece (excluding cover) box, made of 18-gauge, white, powder-coated steel. It shall flush-mount with four wood screws (provided) on standard 16" center wall studs prior to dry wall. The structured media enclosure shall have minimum dimensions of 14.38"h x 14.38"w x 3.60"d with 16.10"h x 16.10"cover.

B. The structured media enclosure shall meet all applicable standards: be UL Listed, comply with all ANSI/TIA/EIA 568-B.2 and ANSI/TIA/EIA 570-A requirements and meet FCC part 68.

PART 3 - EXECUTION

3.01 BACKBOARDS

A. Backboards shall be 3/4" void free plywood. Size of backboard shall be 4' x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of gray fire-retardant paint.

3.02 RESIDENTIAL STRUCTURED MEDIA ENCLOSURE

A. Residential Structured Media Enclosures shall be installed as per the requirements specified by the manufacturer’s installation guidelines and best industry practice.

B. Residential Structured Media Enclosures shall be installed in accordance with the recommendations made in the ANSI/TIA/EIA-570-A standard.

C. Residential Structured Media Enclosures shall be bonded and grounded in accordance with the recommendations made in the J-STD-607-A standard.

END OF SECTION

SECTION 26 09 23

OCCUPANCY SENSORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor's work shall include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. The Contractor/supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.

C. The Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.02 EQUIPMENT QUALIFICATION

A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be UL Listed, offer a 5-year warranty and meet all state and local applicable code requirements.

C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.03 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. The Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the Owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the Owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.04 SUBMITTALS

A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

C. Submit any interconnection diagrams per major subsystem showing proper wiring.

D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.

E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.05 SYSTEM OPERATION

A. It shall be the Contractor's responsibility to make all proper adjustments to assure Owner's satisfaction with the occupancy system.

1.06 ACCEPTABLE MANUFACTURERS

A. The Watt Stopper, or Pre-Approved Equal: For pre-approval, provide all the information listed under section 1.04 A and 1.04 D a minimum of ten (10) working days prior to initial bid date.

B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors which meet or exceed the specifications included herein.

PART 2 - PRODUCTS

2.01 GENERAL

A. All products shall be Watt Stopper product numbers.

1. Ceiling Sensors: WT-605, WT-600, WT-1105, WT-1100, WT-2205, WT-2200, WT-2250, WT-2255, W-500A, W-1000A, W-2000A, W-2000H, WPIR, DT-200, DT-205, CX-100, CX-105, CI-200, CI-205.
2. Wall Sensors: WI-200, WS-120/277, WA-100, WD-170, WD-180, WD-270, WD-280.
3. Power and Slave Packs: B120E-P, B277E-P, C120E-P, C277E-P, S120/277-P, AT-120.
4. HID Control: DM-100.
5. Outdoor Sensors: EW-100, EW-200, EN-100, EN-200.
6. Low Temperature: CB-100.
7. InteleSwitch: TS-200, TS-300, TS-200-24.

B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1,200 watts at 277 volts and shall have 180 degrees coverage capability.

D. Wall switch products shall utilize Zero Crossing Circuitry, which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.

E. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

F. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.

G. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0 mm thickness. Products utilizing a soft lens will not be considered.

H. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.

I. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.

J. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

K. Where specified, passive infrared and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

L. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.

M. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

N. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

O. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within + 0.005% tolerance, 32 kHz within + 0.002% tolerance, or 40 kHz + 0.002% tolerance to assure reliable performance and eliminate sensor crosstalk. Sensors using multiple frequencies are not acceptable.

P. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

Q. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

R. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Setting shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

S. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

T. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

U. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate

components or specially modified units to achieve this function are not acceptable.

V. All sensors shall have UL rated, 94V-0 plastic enclosures.

W. Outdoor motion sensors shall have UL 773A ratings. EWF outdoor sensors shall additionally have UL 1571 ratings.

X. EW-100 outdoor sensors shall cover up to 35 feet, with a field of view of 180 degrees. EW-200 outdoor sensors shall cover up to 52.5 feet, with a field of view of 270 degrees. EN-100 outdoor sensors shall cover up to 35 feet, with a field of view of 90 degrees. EN-200 outdoor sensors shall cover up to 100 feet, with a long range lens view.

Y. EWF outdoor sensors shall include polycarbonate lamp holders that accept PAR 20 or 38 lamps up to 150W per lamp.

Z. Outdoor sensors shall have an operating temperature range of -40 degrees F to +130 degrees F.

AA. To ensure complete protection from weather elements and exposure, outdoor sensors shall be manufactured with precision double-shot tooling and contain internal silicon gaskets.

BB. HID controller shall be compatible with all types of High Intensity Discharge (HID) lamps, including Metal Halide, Metal Halide Pulse Start, and High Pressure Sodium.

CC. HID controller shall operate with HID lamps utilizing Constant Wattage Autotransformer (CWA) type ballasts.

DD. To avoid lamp damage during the HID power up period, the HID controller shall maintain a full light level during lamp warm up for 15 minutes.

EE. To maximize lighting control scenarios, the HID controller shall be compatible with any 24 VDC controlling device, such as occupancy sensors, time switches, control panels, or photocells.

FF. The HID controller shall be capable of linking to other HID control modules to enable effective multi-zone control. More than 100 individual devices shall be capable of being connected.

2.02 CIRCUIT CONTROL HARDWARE – CU

A. Control Units: For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard

electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to minimum of two (2) sensors.

B. Relay Contacts shall have rating of:

13A - 120 VAC Tungsten
20A - 120 VAC Ballast
20A - 277 VAC Ballast

C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

PART 3 - EXECUTION

3.01 INSTALLATION

A. It shall be the Contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90 to 100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The Contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. It is the Contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the Owner's facility, to verify placement of sensors and installation criteria.

C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The Contractor shall also provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.02 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will

verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.

B. The electrical contractor shall provide both the manufacturer and the Electrical Engineer with ten (10) working days written notice of the scheduled commissioning date. Upon completion of the system fine tuning the factory authorized technician shall provide training to the Owner's personnel in the adjustment and maintenance of the sensors.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work required under this section of the Specifications consists of the installation of all switchboards for use on systems 600 volts and below. All materials and devices which are an integral part of the switchboards shall be provided under this section of the Specifications.

B. Switchboards as specified in these Contract Documents are free standing, dead-front, metal enclosed panels of one or more sections. The overcurrent devices may be individually or group mounted.

1.02 QUALITY ASSURANCE

A. Acceptable Manufacturers: Products of the following manufacturers, which comply with these Specifications, are acceptable:

1. Square D
2. Siemens
3. Cutler Hammer
4. ABB-GE

B. Equipment Dimensions

1. Dimensions noted on the Drawings are the maximum allowable and shall not be exceeded. Where switchboard(s) of acceptable manufacturers listed exceed the maximum dimensions, products of such manufacturers shall not be acceptable.

C. Coordination

1. Coordinate installation with architectural and structural features, equipment installed under other sections of the Specifications and electrical equipment to ensure access and so that clearance minimums are provided.

1.03 SUBMITTALS

A. Refer to Section 26 00 00 - Electrical General for submittal requirements.

B. Shop Drawings: Submit shop drawings to indicate compliance with the Contract Documents.

1. Include electrical characteristics and ratings for each switchboard with dimensions, mounting, bus material, voltage, bracing, ampere rating, mains, poles and wire connection, and any accessories.
2. Include bussing diagram indicating each circuit breaker or fused switch position.
3. Provide a schedule indicating overcurrent device, trip and size, poles, frame type, fuse size and type, or circuit breaker interrupting capacity.

1.04 SHORT CIRCUIT AND PROTECTIVE DEVICE STUDY

A. Contractor shall provide a Short Circuit and Protective Device Study to verify the proposed equipment ratings and protective device ratings. The study shall be performed by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems.

B. The scope of the study shall include all proposed distribution equipment supplied under this contract.

C. Contractor shall obtain, in writing, the short circuit current value at the main service switchboard for the specific project location from the utility.

D. All service equipment shall be legibly marked in the field with the maximum available fault current and the date the fault current calculation was performed in accordance with NEC 110.24.

E. A copy of the Short Circuit and Protective Device Study shall be included in the shop drawing submittals for the equipment, and made available to those authorized to design, install, inspect, maintain, or operate the system.

1.05 PROTECTIVE DEVICE COORDINATION STUDY

A. Overcurrent protective devices shall be selectively coordinated for distribution systems serving emergency and standby loads, as well as those serving multiple elevators, for faults with durations at 0.01 seconds.

B. Contractor shall provide a protective device coordination study for:

1. Distribution systems required to be selectively coordinated that contain circuit breakers.
2. Distribution systems containing breakers with adjustable trip settings.
3. Distribution systems requiring arc-flash analysis.

C. The study shall be performed by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems.

D. A copy of the Protective Device Coordination Study shall be included in the shop drawing submittals for the equipment, and made available to those authorized to design, install, inspect, maintain, or operate the system.

1.06 ARC FLASH SAFETY

A. The Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D, and IEEE 1584 – Guide for Performing Arc Flash Hazard Calculations.

B. Arc Flash Hazard Analysis

1. Manufacturer of switchboards and panelboards shall provide an arc flash hazard analysis for the electrical distribution system. Include this study in the shop drawing submittals for the equipment.
2. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E.
3. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.
4. The flash protection boundary and the incident energy shall be calculated and reported at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
5. The arc flash hazard analysis shall include all MV, 575v, and 480v locations and locations in 240 volt and 208 volt systems rated 400 amps and above.
6. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.
7. The arc flash hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
8. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.
9. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584.

10. The report shall indicate incident energy and flash protection boundary calculations as follows:
    a. Arcing fault magnitude
    b. Device clearing time
    c. Duration of arc
    d. Arc flash boundary
    e. Working distance
    f. Incident energy
    g. Hazard risk category
    h. Recommendations for arc flash energy reduction

C. Arc Flash Warning Labels

1. Contractor shall field-install arc flash labels on equipment that includes the available incident energy and required personnel protective equipment (PPE).
2. The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
3. The label shall have an orange header with the wording, "WARNING, ARC FLASH HAZARD," and shall include the following information:
    a. Location designation
    b. Nominal voltage
    c. Flash protection boundary
    d. Hazard risk category
    e. Incident energy
    f. Working distance
    g. Engineering report number, revision number and issue date
4. Labels shall be machine-printed, with no field markings.
5. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings:
    a. For each 600, 480 and applicable 208 volt panelboards and disconnects, one arc flash label shall be provided.
    b. For each motor control center, one arc flash label shall be provided.
    c. For each low voltage switchboard, one arc flash label shall be provided.
    d. For each switchgear, one flash label shall be provided.
    e. For medium voltage switches, one arc flash label shall be provided.
6. Labels shall be field-installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

D. Arc Flash Training

1. The equipment vendor shall train up to four (4) personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the

requirements of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be provided in the equipment manuals.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish all materials specified herein.

B. The switchboard, circuit breakers, and fused devices shall be UL Listed and bear the UL Label. Where a switchboard is utilized as service entrance equipment, it shall be UL Labeled as suitable for such use.

C. The switchboard(s) shall be suitable for operation on the voltage system indicated on the Drawings.

2.02 STRUCTURE ARRANGEMENT

A. The switchboard(s) shall consist of free-standing, standardized vertical sections bolted together to form a continuous structure.

B. Adequate space for conduit and conductors entering the top or bottom, in accordance with the National Electrical Code, shall be provided without structural interference, conductors shall be safely accessible without disrupting service.

C. The structure and all components shall be finished in the manufacturer's standard corrosive-resistant primer and coating.

D. Unless noted otherwise, switchboard sections shall be front accessible.

2.03 BUS ARRANGEMENT

A. All busses shall be [silver-plated copper] [tin-plated aluminum], rated for a 65 degrees C temperature rise above a 40 degrees C ambient. The minimum bus bracing, in RMS-symmetrical-amperes, shall be as shown on the Drawings.

B. A neutral bus bar shall be provided, rated 100% of the main phase bus bar ampacity.

C. The main bus shall be fully rated for the entire length of the switchboard.

D. All non-current-carrying parts of the switchboard shall be grounded through the use of a continuous horizontal ground bus connected to vertical ground busses in each section. Ground bus rating shall meet or exceed the ampacity of the electrical service grounding electrode conductor(s).

E. An accessible cable termination compartment shall be provided for incoming line termination for main lug only applications. Lugs shall be suitable for terminating the size and quantity of conductors as indicated.

F. All terminal lugs shall be UL Labeled for AL or CU conductors rated for 75 degrees C.

2.04 MAIN PROTECTIVE DEVICE(S)

A. The main protective device(s) shall employ fixed type mounting. The devices shall be individually mounted in the switchboard.

B. Provide molded case circuit breaker(s)

1. Breaker(s) shall be 600V AC, 50/60 HZ rated. The frame and current ratings shall be as indicated on the Drawings.
2. Circuit breaker(s) shall be of the quick-make, quick-break, trip-free [thermal magnetic] [solid state] type. [Solid state breaker trip functions shall include adjustments for continuous amperage, long time pickup and delay, instantaneous, and ground-fault pickup and delay.]

C. Provide insulated case circuit breaker(s)

1. Breaker(s) shall be 600V AC, 50/60 HZ rated. The frame and current ratings shall be as indicated on the Drawings.
2. Circuit breaker trip functions shall include adjustments for continuous amperage, long time pickup and delay, instantaneous, and ground-fault pickup and delay. Fault indication shall be provided on the trip unit for overload, short time, short circuit, and ground fault conditions.
3. Breaker(s) must carry a UL 429 Listing, be rated for 100% continuous duty, approved for reverse connection, and shall be stationary mounted, suitable for manual operation. Breaker(s) must carry an individual serial number with factory-maintained production and test records.
4. The breaker operating mechanism shall be a true two-step stored energy mechanism that shall provide a five cycle maximum closing time. Separate indicators shall be provided to show charged/discharged status of the mechanism and open/closed status of the breaker's contacts. The breaker mechanism shall enable to be discharged without closing the main contacts. The manual charging handle shall be interlocked with the manual close button to prevent simultaneous operation.

D. Provide fused switch(es)

1. Switch(es) shall be 600V AC, 50/60 HZ rated and shall be UL Listed for application at 100% of their continuous current rating. The current rating shall be as indicated on the Drawings.

2. Switch(es) shall be bolted pressure contact, load interrupting, fast-acting stored energy type, fused devices. The contact interrupting capacity shall be 12 times the continuous current rating and 200,000 AIC for the combination of switch and fuse. The switch shall have electrical trip mechanism.
3. Fast-acting current limiting fuses shall be installed in each ungrounded leg of the switch.
4. Switch shall be equipped with "blown fuse" protection to automatically trip switch upon loss of any fuse.
5. Switch shall be equipped with factory installed ground fault sensing system and indication.

E. Provide phase-loss protection

1. Phase loss protection system shall trip the main disconnect device(s) under single-phase condition or a voltage imbalance of 12% or more.
2. The system shall not trip on total loss of voltage on all phases and shall have a built-in time delay with a range of 3 - 12 seconds. Capacitor trip component is required.
3. The system shall be equipped with LED fault indicators installed on the front of switchboard enclosure.

2.05 DISTRIBUTION PROTECTIVE DEVICES

A. Provide molded case circuit breakers

1. Circuit breakers shall be provided with trip rating, poles and minimum interrupting rating as indicated on the Drawings or specified herein.
2. Circuit breakers 600 amps or less shall be of the quick-make, quick-break, trip-free thermal magnetic type.
3. Circuit breakers greater than 600 amps shall be of the quick-make, quick-break, trip-free, solid state type. Solid state breaker trip functions shall include adjustments for continuous amperage, long time pickup and delay, instantaneous, and ground-fault pickup and delay.
4. Circuit breakers shall be bolted to the switchboard bus.
5. Provide shunt trip device to electrically trip circuit breakers where indicated on the Drawings.

2.06 AUXILIARY EQUIPMENT

A. Identification

1. Refer to Section 26 00 00 - Electrical General for nameplate requirements.

B. Metering

1. Provide a multi-function, high accuracy digital power metering instrumentation module equipped with an LCD display. The module shall provide measurements for current, voltage and power parameters as follows:
   a. Phase currents, phase voltages, average phase current, average phase voltage, amp demand, neutral current, kW, kW demand, kW hours, kVAR, kVAR hours, power factor, and frequency.

C. Provide surge protective devices (SPD) integral to the switchboard assembly complying with the following:

1. SPD shall be listed and component recognized in accordance with UL 1283 and UL 1449 Third Edition.
2. SPD shall be installed by and shipped from the electrical distribution equipment manufacturer's factory as an integral device to the electrical equipment.
3. SPD shall provide surge current diversion paths for all modes of protection; L-L, L-N, L-G, N-G in WYE systems (L-N or L-G if at service entrance with bonding jumper), and L-L, L-G in DELTA systems.
4. SPD shall be modular in design. Each module shall be fused with a surge rated fuse and incorporate a thermal cutout device.
5. A UL approved disconnect switch shall be provided as a means of disconnect in the switchboard device only.
6. SPD shall meet or exceed the following criteria:
   a. Maximum surge current capability (single pulse rated) shall be 120 KA per mode.
   b. Nominal discharge current rating shall be 20 KA.
   c. MCOV shall not be less than 125% of the nominal system operating voltage.
   d. The maximum ANSI/UL 1449 3rd Edition voltage protection rating for the device shall not exceed the following:

Modes	208Y/120	480Y/277
L-N; L-G; N-G	700	1200
L-L	1200	2000

7. SPD shall have successfully passed ANSI/IEEE C62.41-1991 10 x 1000 µs waveform testing performed by a nationally recognized independent test lab.
8. SPD shall have a minimum EMI/RFI filtering of -50dB at 100 kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.
9. SPD shall be provided with 1 set of NO/NC dry contacts.
10. SPD shall have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install switchboard on 3" high concrete pad, the horizontal dimensions of which shall exceed the base dimensions of the switchboard by 3" on all sides.

B. Lace and group conductors installed with nylon tie straps. Only one conductor shall be installed under each terminal. Form and train conductors in enclosure neatly parallel and at right angles to sides of box. Un-insulated conductor shall not extend beyond 1/8" from terminal lug.

C. Do not splice conductors in switchboard. Where required, install junction box adjacent to enclosure and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the conductors and cables section of the Specifications and do not exceed.

D. Maintain conductor phase color code requirement described in the conductors and cables section of the Specifications.

E. Switchboard name/designation shall be labeled per the requirements of Section 26 00 00 - Electrical General 2.02 A, as well as each individual feeder breaker/fused switch and branch circuit breaker/fused switch.

F. Any circuit breaker provided with arc energy reducing maintenance switch shall be labeled “BREAKER IS PROVIDED WITH ARC ENERGY REDUCING MAINTENANCE SWITCH”. Labeling shall be per the requirements of Section 26 00 00 – Electrical General 2.02A.

3.02 CLEANING AND ADJUSTMENT

A. After completion, clean the interior and exterior of dirt, paint and construction debris.

B. Circuit breaker adjustments shall be performed as directed by the Engineer at projection completion.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 26 00 00 - Electrical General.

B. Provide the panelboards indicated on the Drawings complete with overcurrent protection devices and spaces.

C. This section includes panelboards and distribution panelboards and associated auxiliary equipment rated 600 V or less as shown on the drawings.

D. Refer to panel schedule and one-line power diagram on drawings for specific requirements of each panel.

1.02 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install panelboards, complete, as indicated on the Drawings and as specified herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.03 QUALITY ASSURANCE

A. Panels shall be factory assembled.

B. Coordination: Coordinate installation with architectural and structural features, equipment installed under other sections of the Specifications and electrical equipment to ensure panel access and so that clearance minimums are provided.

C. Components and installation shall be in accordance with NFPA 70, “National Electrical Code,” NEMA PBI, “Panelboards” and UL67 and UL50.

D. Panelboards and load centers shall be listed and identified for use with 75 degrees C rated conductors.

1.04 SUBMITTALS

A. Refer to Section 26 00 00 - Electrical General for submittal requirements.

B. Manufacturers Product Data:

1. Submit material Specifications and installation data for products specified under Part 2 - Products to include:
   a. Overcurrent protection devices
   b. Panelboards

C. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the Contract Drawings.

1. Include electrical characteristics and ratings for each panelboard with dimensions, mounting, bus material, voltage, ampere rating, mains, poles and wire connection, and any accessories. Indicate method of ground bus attachment to enclosure.
2. Include bussing diagram indicating each bussing overcurrent protection device position.
3. Provide a schedule indicating overcurrent protection device type, trip and size, poles, frame type, interrupting capacity.

1.05 SHORT CIRCUIT AND COORDINATION STUDY

A. Overcurrent protective devices shall be selectively coordinated for distribution systems serving emergency and standby loads, as well as those serving multiple elevators, for faults with durations at 0.01 seconds.

B. Manufacturer of switchboards and panelboards shall provide a short circuit and coordination study for:

1. Distribution systems required to be selectively coordinated that contain circuit breakers.
2. Distribution systems containing breakers with adjustable trip settings.
3. Distribution systems requiring arc-flash analysis.

C. Where required for selective coordination purposes, the coordination study shall be included in the shop drawing submittals for the equipment.

1.06 ARC FLASH SAFETY

A. The Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D, and IEEE 1584 – Guide for Performing Arc Flash Hazard Calculations.

B. Arc Flash Hazard Analysis

1. Manufacturer of panelboards shall provide an arc flash hazard analysis for the electrical distribution system. Include this study in the shop drawing submittals for the equipment.
2. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.
3. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.
4. The flash protection boundary and the incident energy shall be calculated and reported at all significant locations in the electrical distribution system (panelboards) where work could be performed on energized parts.
5. The arc flash hazard analysis shall include all MV, 575v, and 480v locations and locations in 240 volt and 208 volt systems rated 400 amps and above.
6. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.
7. The arc flash hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
8. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.
9. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2.
10. The report shall indicate incident energy and flash protection boundary calculations as follows:
    a. Arcing fault magnitude
    b. Device clearing time
    c. Duration of arc
    d. Arc flash boundary
    e. Working distance
    f. Incident energy
    g. Hazard risk category
    h. Recommendations for arc flash energy reduction

C. Arc Flash Warning Labels

1. Contractor shall field-install arc flash labels on equipment that includes the available incident energy and required personnel protective equipment (PPE).
2. The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
3. The label shall have an orange header with the wording, "WARNING, ARC FLASH HAZARD," and shall include the following information:
   a. Location designation
   b. Nominal voltage
   c. Flash protection boundary
   d. Hazard risk category
   e. Incident energy
   f. Working distance
   g. Engineering report number, revision number and issue date
4. Labels shall be machine-printed, with no field markings.
5. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings:
   a. For each 600, 480 and applicable 208 volt panelboards and disconnects, one arc flash label shall be provided.
6. Labels shall be field-installed by the engineering service division of the equipment manufacturer.

D. Arc Flash Training

1. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Panelboard manufacturer shall be:

1. Siemens
2. Square D
3. ABB-GE
4. Cutler-Hammer

B. Coordination panelboard manufacturer (fusible panelboards) shall be:

1. Cooper Bussman
2. Mersen

2.02 GENERAL REQUIREMENTS

A. All panels and overcurrent protection devices shall be UL Listed and bear a UL Label. Where panel serves as service entrance equipment, panel shall bear a UL Label indicating suitability as service entrance equipment.

B. Panels shall be of the dead front safety type.

C. Provide panels complete with factory assembled circuit breakers or fuses connected to the bus bars in the positions shown on the panel schedules.

D. Provide all panelboards fully rated to the A.I.C. ratings noted on the schedules, but not less than 10,000 amperes for 120/208 volt panelboards and not less than 14,000 amperes for 277/480 volt panelboards. All devices in a panelboard shall be rated for the A.I.C. ratings shown for the panelboard.

2.03 BUSSING AND INTERIORS

A. All bus bars shall be [copper] [aluminum]. Main lugs and main overcurrent protection devices shall be UL approved for copper or aluminum conductors and shall be of a size range for the conductors indicated on the drawings. Each panel shall contain a full size grounding bus. All panelboards shall contain a full size insulated neutral bus unless otherwise indicated on the drawings.

B. The neutral and ground bus shall have a sufficient number of lugs to singularly terminate each individual conductor requiring a connection.

C. Where designated on panel schedule as “space,” include all necessary bussing, device support and connections. Provide blank cover for each space.

D. Where specified or indicated on the drawings, provide sub-feed lugs adjacent to the mains or feed-through lugs opposite end of mains and increase box heights to provide additional cable bending and termination space. Lugs to be the same size and capacity as mains and rated for aluminum or copper conductor terminations.

2.04 ENCLOSURES

A. Panelboard width shall not be less than twenty inches unless indicated on the drawings (32" minimum for distribution panelboards).

B. Provide concealed captive clamping devices, concealed hinges and chrome lock for all flush mounted panels. Key all panels throughout project alike.

C. Where two section panels are required, both sections shall have fully rated bus, separate cabinets connected by conduit nipples. Interconnect sections with copper conductors with ampacity equal to rating of main bus. Route phase and neutral conductors together between panels. Provide separate trims for each section.

D. Panelboard trims for surface mounted panelboards shall be continuously hinged on one side so that when opened, wiring gutters are completely exposed.

E. Provide a label for each branch circuit, feeder, and main circuit breaker in distribution panels, permanently attached per the requirements of Section 26 00 00 - Electrical General, 2.02A.

F. Cabinets, flush or surface mounted as indicated. NEMA PB-1, Type 1 enclosure, except where the following enclosure requirements are indicated:

1. NEMA 250, Type 3R - Raintight.
2. NEMA 250, Type 3S - Raintight and dust tight.
3. NEMA 250, Type 4X - Corrosion-resistant stainless steel enclosure, watertight, dust tight, and resistant to oil and coolant seepage. This type shall be used in kitchen areas.
4. NEMA 250, Type 12 - Dust tight, drip proof, and resistant to oil and coolant seepage.

G. Enclosure shall be fabricated with galvanized steel. Trims shall have electrostatic applied ANSI gray enamel finish and adjustable indicating trim clamps for securing trim to the enclosure. Screwed-on trims shall not be acceptable. Trim shall have an angle support along the bottom serving as a support between trim and enclosure for safe installation and removal of trim.

H. Exterior Panels: Panelboards mounted outside of building shall be in NEMA type 3R enclosures. Panelboards shall have in addition to the standard specified items the following:

1. Piano hinge
2. Seams continuously welded
3. Rolled lip around door and cabinet
4. No knockouts or holes
5. Neoprene gaskets on inside of door
6. Stainless steel hardware
7. Drip hood at top above door

2.05 CIRCUIT BREAKERS

A. Interrupting rating of all circuit breakers in panelboards shall have UL rating of not less than the RMS symmetrical amps indicated on the Drawings at system voltage. Series rated devices are acceptable with the following exceptions: devices used in distribution serving emergency, standby and multiple elevator loads (selective coordination).

B. Circuit breakers shall be provided with trip rating and poles as indicated on the drawings or specified herein.

C. Multi-pole breakers shall be common trip and common reset; tie handle connection between single pole breakers is not acceptable.

D. Branch circuit breakers in lighting and appliance panels shall be quick-make, quick-break, thermal magnetic type bolted to the bus. Circuit breakers in distribution type panelboards shall be bolted to the bus.

E. Provide the following special devices and accessories when indicated on the drawings or specified herein.

1. Ground fault interrupting circuit breakers (GFI) where indicated on the drawings.
2. Provide handle lock-on device (to prevent manually turning off device without removal) for all overcurrent devices where indicated on panelboard schedules, and for those protecting circuits serving fire alarm equipment, and for those dedicated for powering emergency battery-powered unit equipment.
3. Provide UL Listed “SWD” switching duty circuit breakers on the devices indicated on the drawings.
4. Provide shunt trip device for electrically tripping circuit breakers indicated on the drawings.
5. Overcurrent protective devices for fire alarm circuits shall have handles that are factory-marked in the color red.

2.06 LOAD CENTERS

A. Individual apartment unit panels shall be “Load Center” type of amperage indicated on drawings.

B. Branch breakers shall be plug-in type.

C. Arc-fault circuit breakers shall protect 15- and 20-amp branch circuits in dwelling units serving lighting, receptacles and smoke detectors [located in bedrooms] [except for those located in kitchens, bathrooms, garages, and outdoors] [except for those located in bathrooms, garages and outdoors].

D. Load center trims shall be factory-painted white.

2.07 FUSIBLE COORDINATION PANELBOARDS

A. Interrupting rating of all fuses in panelboards shall have UL rating of not less than the RMS symmetrical amps indicated on the Drawings at system voltage.

B. Fusible panelboards shall be listed to UL 67.

C. Furnish 10% or minimum of three fuses of each rating and type of fuse installed, in addition to any spares indicated in schedule.

D. Panelboard overcurrent device interrupting ratings shall be fully rated for the maximum available fault current and have a U.L. listed interrupting rating of 300kA and CSA certified interrupting rating of 200kA.

E. Panelboard circuits 100A and less shall incorporate overcurrent protection and branch-circuit disconnecting means into a single integrated component.

F. Interiors shall be factory assembled.

G. Panelboard shall be equipped with a six-space spare fuse compartment for storing replacement branch circuit fuses.

H. Bus bars shall be tin-plated copper.

I. Neutrals shall be fully rated.

J. Where equipped with main disconnect, permanently installed lockout means shall be provided on the disconnect for lockout tag procedures.

K. Main disconnect shall be quick-make, quick-break type.

L. A listed SPD shall be provided in or on emergency system panelboards.

M. Main and Branch Overcurrent Protection

1. All overcurrent protective devices shall have a minimum U.L. listed interrupting rating of 300kA and CSA Certified interrupting rating of 200kA.
2. Main overcurrent protective devices shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR Class J time-delay fuses or Class J performance fuses.

3. Branch circuit overcurrent protection shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR finger-safe fuse with Class J performance fuses.
4. Where panelboard main fuses are installed, fuses in panelboard branch circuits shall selectively coordinate with main fuses for all overcurrents up to 200kA.

N. Branch fused disconnects

1. Device shall have visible ON/OFF indication with colored and international symbol markings.
2. Device shall provide open fuse indication permanently installed neon indicating light.
3. Device shall be UL and cUL Listed 600Vac/200kA or 125Vdc/100kA voltage/short-circuit current rating, load-break disconnect with amp ratings and number of poles as indicated on the panelboard schedule.
4. Fuse and disconnect assembly shall be a finger-safe component with trim installed.
5. Fuse and disconnect shall be interlocked to disallow fuse removal while fuse terminals are energized.
6. No special tools shall be required for fuse removal.
7. Devices shall have bolt-on style bus connectors.
8. Device housing shall be clearly marked with device amperage.
9. Device shall provide fuse amp rating rejection at the following ampacities to ensure continued circuit protection at the specified circuit rating: 15A, 20A, 30A, 40A, 50A, 60A, 70A, 90A and 100A.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide from each flush mounted panelboard four (4) 3/4" empty conduits stubbed out above ceiling line and capped (not applicable to living unit load centers).

B. Install panelboards in accordance with NEMA PB1.1, “General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less” and manufacturer’s written installation instructions.

C. Mount panelboards with top circuit breaker not more than 6'-6" above finished floor.

D. Only one conductor installed under terminal of individual circuit breakers. Form and train conductors in panel enclosure neatly parallel and at right angles to sides of box. Un-insulated conductor shall not extend beyond one-eighth inch from terminal lug.

E. Do not splice conductors in panels. Where required, install junction box adjacent to panel and splice or tap conductors in box.

F. Bond the equipment grounding terminal buses of the normal and essential branch circuit panelboards serving patient care areas in accordance with the requirements of NEC Article 517.14.

G. Mounting and Support

1. Mounting
   a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. Panelboards 600 amp and larger shall be secured by a minimum of eight (8) devices. A 1.5 inch minimum diameter round washer shall be used between head of screw or bolt and enclosure.
   b. Enclosures shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified.
   c. Attach enclosure directly to masonry, concrete, or wood surfaces.
   d. Mounted enclosure on metal channel (strut), which is connected to structure with fastening device specified, for installation on steel structure or sheet rock walls.

H. Maintain conductor phase color code requirements described in the conductors and cables section of the specifications.

I. A typewritten branch circuit directory (based on as-built conditions) shall be provided for each panelboard and load center, permanently mounted on inside of door in a transparent, protective cover. Room number(s) or room name(s) shall be included in the circuit description in coordination with the final naming/numbering scheme for the project (e.g. “Office Receptacles” shall read “Office Receptacles – Rm. 202, 203”).

J. Any circuit breaker provided with arc energy reducing maintenance switch shall be labeled “BREAKER IS PROVIDED WITH ARC ENERGY REDUCING MAINTENANCE SWITCH”. Labeling shall be per the requirements of Section 26 00 00 – Electrical General 2.02A.

K. Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289, “Application Guide for Ground Fault Circuit Interrupters.”

L. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

M. Mounting of all panelboards and all hardware used for mounting shall be in accordance with the seismic criteria per the applicable building code.

N. Fusible coordination panelboards shall be shipped without branch circuit fuses installed. Branch circuit fuses shall be shipped separately with the chassis. Where main fuses are specified 100A or greater, equipment shall be shipped with main fuses installed.

END OF SECTION

SECTION 26 26 53

ELECTRIC VEHICLE CHARGING EQUIPMENT

Reminder: City of Atlanta is now requiring a Ration of 1:5 parking spaces in new construction to be provided with EV infrastructure (conduit and space allocation only) to accommodate the future installation of EV Charging Equipment. Refer to the EV Ordinance for more information.
L:\JSE Documents\JSE (Corporate)\Technical\Codes, Laws and Standards\State and Local Requirements\Georgia\Atlanta\Electric Vehicle Ordinance

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work to be done under this section of the specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of EV charging equipment that provides Level 2 EV charging. Furnish and install all Electric Vehicle Charging Systems as specified herein and as indicated on the drawings.

C. The drawings and specifications are complementary to each other and what is called for by one shall be as binding as if called for by both.

1.02 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Comply with UL 2231-1. UL 2231-2, UL 2594, and NEC Article 625.

D. Comply with SAE J1772.

E. Comply with FCC Part 15 Class A.

1.03 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for EV charging equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For EV charging equipment.

1. Include plans, elevations, sections, and mounting/attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of mounting assemblies for EV charging equipment.
4. Include diagrams for power, signal, and control wiring.
5. Include verification of wireless communications service at each location of EV charging equipment.

1.04 WARRANTY

A. Comply with the requirements of the General Conditions and Section 26 00 00.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Electric Acceptable Manufacturers: Products of the following manufacturers, which comply with these Specifications, are acceptable:

1. ChargePoint
2. Schneider Electric
3. Leviton

2.02 EV CHARGING EQUIPMENT DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. ADA compliant.

D. Metering: +/- 2 percent from 2 percent to full scale of output (30 A).

E. EV Charging Equipment Mounting: [Bollard mount] [Wall mount].

F. Enclosures:

1. Rated for environmental conditions at installed location.
   a. Indoor Locations: NEMA 250, Type 3R.
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Aluminum and UV-resistant plastic.
   d. Paint and Anodized.
   e. Charging components protected by security screws.
   f. Charging connectors in locking holsters.
   g. Meter, modem, and CPU, tamper resistant.

G. EV Cable and Connectors:

1. SAE J1772 connector(s) with locking holster.
2. 18-foot (5.5 m) cable(s) with cable management system.

H. Status Indicators:

1. LEDs to indicate power, vehicle charging, charging complete, system status, faults, and service, as well as authorization.

I. Display Screen:

1. VGA-resolution, daylight-viewable LCD screen with UV protection. Daylight readable and fingerprint resistant.
2. Displays power, charging, charging complete, remote control, system status, faults, payment and pricing details, and service.

J. Networking:

1. WAN Communications: Cellular GSM/GPRS and CDMA.
2. LAN Communications: 2.4 GHz Wi-Fi 802.11b/g/n.
3. Capable of remote configuration, diagnostics and reporting.
4. Capable of remote software updates (future proof).

K. Payment System:

1. RFID (ISO 15693, ISO 14443), NFC, Contactless credit card reader.
2. PCI (Payment Card Industry) compliant.
3. Capable of remote control and authorization including mobile phone application or toll-free phone number.

L. Charging Network:

1. Multiple units shall independently connect to charging network.
2. Multiple units shall have one unit designated as a master unit that is configured as a gateway unit between the EV charging equipment and the charging network.
3. Individual units shall be capable of indicating station status and availability providing or connecting user to customer support and remote control.

2.03 PERFORMANCE REQUIREMENTS

A. Surge Withstand: 6 kV at 3000 A.

B. Integral GFCI.

C. Auto-GFCI fault retry.

D. EV Charging Levels:

1. Single vehicle: AC Level 2 at up to 7.2 kW per vehicle.
2. Dual vehicles, AC Level 2 at up to 7.2 kW per vehicle.
3. Multiple vehicles simultaneously charging at a site using Automatic Power Load Management may be charged up to 7.2 kW per vehicle.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for EV charging equipment electrical conduit to verify actual locations of conduit connections before equipment installation.

C. Examine walls, floors, and pavement for suitable conditions where EV charging equipment will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. All installation work shall be performed by a qualified person who is familiar with the installation, construction and operation of the equipment and the hazards involved.

B. Install per manufacturer’s recommendations and contract documents.

C. Install units plumb, level and rigid without distortion.

D. The station shall be floor mounted using the plate/pole assembly, J-Bolts and associated parts per manufactures recommendations.

E. Installation of the Station and Network shall follow the procedure in the published literature.

3.03 CONNECTIONS

A. Connect wiring according to Section 26 05 19.

B. Comply with grounding requirements in Section 26 05 26.

C. Comply with requirements for installation of conduit in Section 26 05 33.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. For each unit of EV charging equipment, perform the following tests and inspections:
   a. Unit self-test.
   b. Operation test with load bank.
   c. Operation test with EV.
   e. Network communications test.

D. EV charging equipment will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 13

MODULAR METERING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Utility Company Furnished Metering Equipment: Install all current transformers, kWh [and/or] [demand] meters, and associated metering equipment furnished by the electric service utility per utility company standards.

B. Contractor Furnished Metering Equipment: Furnish and install the modular metering equipment and service equipment per the Contract Documents, National Electrical Code, and the utility company standards.

1.02 REFERENCES

A. ANSI C12.1, American National Standard Code for Electricity Metering.

B. Unless noted otherwise, the equipment shall be UL Listed as suitable for use as service entrance equipment.

C. Utility company metering standards. The Contractor shall coordinate supply voltage and phase, and output voltage and phase with the electrical utility company and the Contract Documents.

1.03 EQUIPMENT DESCRIPTION

A. The [wall] [floor] mounted metering system shall be [indoor NEMA 1] [outdoor NEMA 3R], and installed with clearances per NEC Article 110.

B. The metering equipment shall be surface mounted.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store the equipment and materials in an indoor location with controlled temperature and humidity, as recommended by the manufacturer.

1.05 WARRANTY

A. The manufacturer shall provide a 3-year (minimum) limited warranty for repair and replacement of the equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Contractor-furnished metering equipment shall be Cutler-Hammer, General Electric Company, Siemens Energy and Automation, Square D, or approved equal.

B. The Metering Equipment shall be furnished by the same supplier as the electrical distribution equipment. The equipment supplier shall be responsible for coordinating the installation and calibration of the metering equipment with the electrical distribution equipment.

2.02 MATERIALS

A. The metering equipment shall have an AIC rating as shown on the drawings. Unless noted otherwise, series rated equipment is acceptable.

B. The housing shall be formed and welded code gauge steel. All components shall be factory assembled. Sockets shall be rated for continuous duty.

C. Blank covers shall be provided for all unused sockets. If the metering equipment is to be energized prior to installation of all meters, provide insulated and sealed blanks for each unused socket.

D. For each assembly, the mains service disconnect shall be [an integral, separate] [a circuit breaker, fused switch, lugs in an underground pull box].

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that the connections to the metering equipment are complete, correct, and ready to accept the installation of the conductors.

B. Verify field voltages, CT ratios, measurements, etc. are as shown on the Drawings.

3.02 LOCATION

A. Location of the metering equipment shall meet NEC Article 110.

3.03 INSTALLATION

A. Provide pairs of ultraviolet resistant, weatherproof, machine printed adhesive labels to identify each meter socket with the corresponding tenant panel.

Lettering shall be black on white or silver background. Size shall be as approved by the building inspector and Architect.

B. Any circuit breaker rated 1200A or more shall be provided with arc energy reducing maintenance switch. Breaker shall be labeled "BREAKER IS PROVIDED WITH ARC ENERGY REDUCING MAINTENANCE SWITCH". Labeling shall be per the requirements of Section 26 00 00 – Electrical General 2.02A.

C. Install the equipment and all associated sensors, devices, conductors, etc. per the manufacturer's instructions. Specific attention shall be paid to the manufacturer's instruction on application of voltages.

D. Install required safety labels. Provide a voltage/phase label at each service disconnecting means.

E. Where used as service equipment, provide service ground connection, as shown on the electric riser diagram.

3.04 FIELD QUALITY CONTROL

A. Inspect the installed wiring systems for completeness, tightness or terminations, grounding, and physical damage.

B. Check tightness of all accessible mechanical and electrical connections. If and where noted, use calibrated electrical meters, and torque wrench(es). Minimum acceptable values shall be as specified in the equipment manufacturer's instructions.

3.05 ADJUSTING

A. Adjust all controls, settings, OCPDs, access doors, operating handles for free mechanical and/or electrical operation as described in the equipment manufacturer's instructions.

3.06 CLEANING

A. All metering equipment and associated raceway systems shall be cleaned prior to the pulling of conductors. Clean the exposed portions of all conductors within panelboards, junction boxes, and other equipment to remove pulling lubricant, construction debris, dirt, and shipping materials.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 26 00 00 - Electrical General.

1.02 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install wiring devices, complete, as indicated on the Drawings and as specified herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. The following manufacturers are allowed:

1. Hubbell
2. Pass & Seymour
3. Cooper
4. Leviton
5. Thomas & Betts/Steel City
6. Walker/Wiremold

When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

C. This section includes receptacles, connectors, switches, dimmers, timeclocks and coverplates.

1.03 QUALITY ASSURANCE

A. Wiring devices shall comply with applicable sections of NEMA Standard WD-1, NFPA 70, Article 100.

B. All special purpose receptacles shall be NEMA standard configuration.

C. Comparative devices by acceptable manufacturers are equal.

PART 2 – PRODUCTS

2.01 WIRING DEVICE DESCRIPTION AND MANUFACTURER – COMMON AREAS

A. Single & Duplex Receptacles (20 Amp)

1. Single or duplex type receptacle as indicated. 125V/20/A/2P/3W/G rating - NEMA - 5-20R type.
2. Face color shall be _____ (red where on emergency circuit).
3. Manufacturer
   a. Hubbell 5362

B. GFCI Duplex Receptacles

1. Duplex, feed-thru type ground fault current interrupter receptacle with test/reset buttons. 125V/20A/2P/3W/G rating - NEMA 5-20R type conforming to UL #498, UL #943 Class A and NEMA #WD1-4.02.
2. Manufacturer
   a. Hubbell GF20 Series

C. Isolated Ground Single & Duplex Receptacles

1. Single or duplex type receptacles as indicated. 125V/20A/2P/3W/IG rating - NEMA 5-20R type ground internally isolated from receptacle frame and ground pigtail or terminal screw.
2. Manufacturer
   a. Hubbell IG5352

D. Clock/Flat Screen Receptacles

1. Single type receptacle with a recessed outlet clock hanger type mounting coverplate. 125V/15A/2P/3W/G - NEMA 5-15R type.
2. Manufacturer
   a. Hubbell RR151CH Series

E. Maintained Contact Switches

1. Provide toggle operated switches SPST, DPST, 3-way or 4-way operation as indicated. 277V/20A rating, quiet type, maintained contact, and a green hexagonal ground screw or ground pigtail, and side wired.
2. Manufacturer
   a. Hubbell 1221 Series (Color to match receptacles).

F. Momentary Contact Switches

1. Provide toggle or key operated switches as indicated with single circuit, 3-position center-off operation. 277V/20A rating, quiet type, momentary contact, spring loaded switch, and green hexagonal ground screw or ground pigtail, back and side wired.
2. Manufacturer
   a. Hubbell HBL 155* (Color to match receptacle).

G. Maintained Contact Slider Type Switch (For Multi-Ganging with Dimmers)

1. Slide-operated switch (to match dimmer), single pole, 3-way or 4-way operation as indicated, 120/277V, 20A rating.
2. Manufacturer
   a. Leviton Monet Series
   b. Lutron Nova T Series

H. Slider Type Wall Box Dimmers

1. Slide operated AC solid state type dimmer with positive ON/OFF switching, integral surge protection, voltage stabilized output, RFI filtered and maximum lighting level adjustment. 120V/60Hz, unless noted otherwise, with lettering and/or nameplate as indicated. Dimmers shall have lowest profile available (wattage permitting).
2. Manufacturer

	Load Type				
	Incandescent/ Halogen	Dimmable CFL/LED (screw base)	Magnetic low voltage	Electronic low voltage	0-10V Fluorescent/ LED
Lutron Nova T Series	NT-600-XX	NTCL-253P-XX	NTLV-600-XX	NTELV-600-XX	NTSTV-DV-XX
Leviton SureSlide Series	6673-10X	6672-1LX	6611-PX	6615-P0X	
Leviton Renoir Series					AWSMG-7DW

I. Illuminated Toggle Switches

1. Single pole, 3-way or 4-way, as indicated, conforming to UL #20, NEMA #WDI-3.02 and F.S. #W-S-896E. 277V/20A rating, quiet type, maintained contact, and a green hexagonal ground screw or ground pigtail, back and side wired. Red colored toggle to glow when switch is on.
2. Manufacturer
   a. Hubbell HBL 1221PL

J. Weather-Resistant Receptacles

1. All 15- and 20-amp receptacles installed in damp or wet locations shall be listed weather-resistant type.

K. Tamper-Resistant Receptacles

1. All 125-volt, 15- and 20-amp receptacles in guest rooms, guest suites and childcare facilities shall be listed tamper-resistant receptacles.
2. All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles in the areas indicated below shall be listed tamper-resistant receptacles.
   a. Guest rooms and guest suites of hotels and motels
   b. Child care facilities
   c. Preschools and elementary education facilities
   d. Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities
   e. Subset of assembly occupancies including places of waiting transportation, gymnasiums, skating rinks, and auditoriums
   f. Dormitories

L. Special Duty Receptacles

1. Hospital grade receptacles shall be provided for all outlets in all patient rooms, in all nurse stations or other patient care areas.
2. All receptacles supplied from the essential electrical system shall be readily identifiable and have an illuminated face or an indicator light to indicate that there is power to the receptacle.
   a. Manufacturer
      1) Hubbell 8200REDLTRA
3. Safety type receptacles shall be provided in all pediatric and psychiatric units.

M. Controlled Duplex Receptacles (20 Amp)

1. Duplex type receptacle, 125V/20/A/2P/3W/G controlled by an automatic control device (or by an automatic energy management system) shall be permanently marked with the universal “power” symbol to differentiate them from non-controlled receptacles.
2. Face color shall be _____
3. Manufacturer
   a. Hubbell BR20C1 – Split Wired
   b. Hubbell BR20C2 – Both Outlets Controlled

2.02 WIRING DEVICE DESCRIPTION AND MANUFACTURER – DWELLING UNITS

A. Duplex Receptacles (15 Amp)

1. 125V/15A/2P/3W/G rating - NEMA 5-15 R type, duplex receptacle with green hexagonal ground screw, mounting frame with plaster ears, back and side wired.
2. Face color shall be _____.
3. Manufacturer
   a. Leviton T5820-* Series
   b. Hubbell

B. GFCI Duplex Receptacles

1. Duplex, feed-thru type ground fault current interrupter receptacle with test/reset buttons. 125V/20A/2P/3W/G rating - NEMA 5-20R type conforming to UL #498, UL #943 Class A and NEMA #WD1-4.02.
2. Manufacturer
   a. Leviton T7899 or approved equal
   b. Hubbell

C. Clock/Flat Screen Receptacles

1. Single type receptacle with a recessed outlet clock hanger type mounting coverplate. 125V/15A/2P/3W/G - NEMA 5-15R type.
2. Manufacturer
   a. Leviton 5320-* Series
   b. Hubbell RR151CH Series

D. Maintained Contact Switches

1. Provide toggle operated switches SPST, DPST, 3-way or 4-way operation as indicated. 120V/15A rating, quiet type, maintained contact, and a green hexagonal ground screw or ground pigtail, back and side wired.
2. Manufacturer
   a. Leviton 1451-2 (Color to match receptacles)
   b. Hubbell RS115 Series

E. Maintained Contact Slider Type Switch (For Multi-Ganging with Dimmers)

1. Slide-operated switch (to match dimmer), single pole, 3-way or 4-way operation as indicated, 120/277V, 20A rating.
2. Manufacturer
   a. Leviton Monet Series
   b. Lutron Nova T Series

F. Slider Type Wall Box Dimmers

1. Slide operated AC incandescent solid state type dimmer with positive ON/OFF switching, integral surge protection, voltage stabilized output, RFI filtered and maximum lighting level adjustment. 120V/60Hz, unless noted otherwise, with lettering and/or nameplate as indicated. Dimmers shall have lowest profile available (wattage permitting).
2. Manufacturer

	Load Type				
	Incandescent/ halogen	Dimmable CFL/LED (screw base)	Magnetic low voltage	Electronic low voltage	0-10V Fluorescent/ LED
Lutron Nova T Series	NT-600-XX	NTCL-253P-XX	NTLV-600-XX	NTELV-600-XX	NTSTV-DV-XX
Leviton SureSlide Series	6673-10X	6672-1LX	6611-PX	6615-P0X	
Leviton Renoir Series					AWSMG-7DW

G. Illuminated Toggle Switches

1. Single pole, 3-way or 4-way, as indicated, conforming to UL #20, NEMA #WDI-3.02 and F.S. #W-S-896E. 120V/20A rating, quiet type, maintained contact, and a green hexagonal ground screw or ground pigtail, back and side wired. Lighted toggle to glow when switch is off.
2. Manufacturer
   a. Leviton 1461-LHC

H. Tamper-Resistant Receptacles

1. All 125-volt, 15- and 20-amp receptacles in a dwelling unit shall be listed tamper-resistant receptacles.

I. Weather-Resistant Receptacles

1. All 15- and 20-amp receptacles installed in damp or wet locations shall be listed weather-resistant type.

J. Tamper-Resistant Receptacle with USB Chargers

1. Device shall include two 15-amp tamper-resistant receptacles and two 5-volt DC USB 2.0 and 3.0 compatible charging ports.
2. Where shown on drawings as ground-fault protected, device shall be wired from load-side of a GFCI receptacle.
3. Manufacturer
   a. Pass & Seymour TM826USB*CC6

2.03 COVERPLATE DESCRIPTION AND MANUFACTURER – COVERPLATES

A. Flush Mounted Interior Receptacle/Switch Coverplates

1. Single or multi-gang to match device type. Medium size (4-7/8" min.), standard depth, smooth finish with nylon material.
2. Color to match device color.
3. Coverplates in mechanical/electrical equipment rooms and high abuse areas shall be stainless steel, non-magnetic.
4. Coverplates flush mounted in exposed masonry construction shall be jumbo type.
5. Manufacturer
   a. Hubbell NPJ Series (nylon)
   b. Hubbell SS Series (stainless steel)

B. Weatherproof Device Coverplates

1. Provide weatherproof “in use” cast aluminum lockable covers. Plastic covers are allowed on dwelling balconies.
   a. Hubbell WP Series
   b. Thomas & Betts Russell Stoll Series

C. Security Coverplates

1. Security coverplates shall be one-piece #14 cold-rolled zinc-plated steel with ground tab. Plates shall have polyester powder-coated white finish. Backplates shall be #10 galvanized steel, and shall use 4 #8-32 x 1/2" stainless steel T-20 torxhead screws with center-pin reject. Plate shall be UL Listed.
   a. Single-pole Switch Hubbell SWP1
   b. Duplex receptacle Hubbell SWP8

D. Multi-Outlet Raceway

1. Product Description
   a. Two-piece rectangular surface raceway of length as prescribed. Stainless steel type 304 housing complete with all bends, fittings, couplings, caps and mounting hardware.
   b. Single 15A/125V grounding outlets UL Labeled and full length ground wire.
   c. Outlets 18" on centers starting no less than 9" from end.
   d. Maximum of six outlets per circuit. Where two or more circuits are utilized the outlets shall be on alternate circuits.
2. Manufacturers
   a. Walker/Wiremold
   b. Hubbell

2.04 MISCELLANEOUS ITEMS

A. Time Switches

1. Electronic Astronomical Schedule Type
   a. 365 day scheduling, solid state, skip-a-day feature, daylight saving changeover, leap year adjusted with capacitor backup, DPDT-120V/20A rated contacts, light sensor input.
   b. Acceptable Manufacturer
      1) Tork DZS Series (channels as required)

B. Photoelectric Control Switches

1. Product Description
   a. Raintight photoelectric self-contained control for switching.
   b. Die-cast housing with adjustable sensor.
2. Manufacturers
   a. AMF/Paragon
   b. Tork 2100 Series

C. Lighting Contactor

1. Product Description
   a. Multi-pole contactor for switching branch circuit tungsten and ballast lighting and resistant heating loads.
   b. Number of poles as indicated (paralleling multiple contactors is acceptable), poles rated for 20 amperes @ 600V continuous duty.
   c. Mechanically held contactor with coil clearing contacts, operating coil voltage to match circuit characteristics.
   d. Housed in panelboard (if indicated).

D. Poke-thru Floor Devices

1. Product Description
   a. Refer to drawings for specific features.
   b. Device shall meet UL 514A requirements for scrubwater test standards.
2. Manufacturer
   a. Hubbell
   b. Walker/Wiremold
   c. Thomas & Betts/Steel City

E. Single/Multiple Station Smoke Alarms: Each sleeping room shall be provided with a smoke alarm. Alarms shall be 120V (with battery back-up) with built-in evacuation horn, power-on indicator and auxiliary contact. Where more than one is installed in a dwelling unit, activation of one detector shall trigger all alarms in that unit. Alarms shall have integral alarm silencing feature.

F. Single/Multiple Station Combination Smoke/Carbon Monoxide Alarms: Each area outside of a sleeping room shall be provided with a combination smoke/carbon monoxide alarm. Alarms shall be 120V (with battery back-up) with built-in evacuation horn, power-on indicator and auxiliary contact. Where more than one is installed in a dwelling unit, activation of one detector shall trigger all alarms in that unit. Alarms shall have integral alarm silencing feature.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All dimmer circuits shall have dedicated neutrals.

B. Install decorative plates on switch, receptacle, and blank outlets when indicated.

C. Install devices and wall plates flush and level.

D. Coordinate the exact location of wiring devices with other trades and architectural features. Do not locate devices on two different architectural finishes such as half on wall tile and half on painted surface, unless noted otherwise.

E. Provide plaster rings in areas requiring them due to construction.

F. Where more than one device is indicated, arrange in gangs covered with one coverplate per manufacturer's instructions.

G. Where dimmer(s) and switch(es) are shown adjacent to one another, switch(es) shall be a maintained contact switch matching dimmer style, so that a common, multi-gang faceplate can be used.

H. Provide 6" long ground wire from grounding lug to all switches and receptacles to a screw type bonding device on the conduit or outlet box.

END OF SECTION

SECTION 26 28 16

DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 26 00 00 - Electrical General.

1.02 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install disconnect switches, up to 1200 amps, complete, as indicated on the Drawings and as specified herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

C. This section includes fuses.

D. This section includes individually mounted enclosed switches used for the following:

1. Service disconnecting means.
2. Feeder and branch-circuit protection.
3. Motor and equipment disconnecting means.

1.03 SUBMITTALS

A. Product Data: For each type of switch and fuse accessory, and component indicated, include dimensions and manufacturer’s technical data on features, performance, electrical characteristics, ratings, and finishes.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA AB 1, NEMA KS 1 and UL 98.

C. Comply with NFPA 70.

D. Comply with NEMA FU 1.

E. Source Limitations: Provide fuses from a single manufacturer.

1.05 COORDINATION

A. Coordinate layout and installation of switches and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer of fusible and non-fusible switches shall be Cutler-Hammer, General Electric, Siemens or Square D Company.

B. Manufacturer of fuses shall be Bussman, Gould Shawmutt or Littelfuse.

2.02 ENCLOSED SWITCHES

A. All disconnect switches shall be heavy duty type with lockable handles (general duty allowed for equipment serving dwelling units).

B. Enclosed, non-fusible switch: NEMA KS 1.

C. Enclosed, fusible switch, 800A and smaller: NEMA KS 1 with clips to accommodate specified fuses and interlocked with cover in closed position.

D. Furnish and install all safety type disconnecting switches indicated on the drawings, specified or required by the National and/or State Electrical Code. Switches shall be externally operable. If the size is not shown on the drawings, the subcontractor shall size the disconnect switch in accordance with name plate data of the equipment they serve.

E. Coordinate with other trades that may provide unit mounted disconnect switches prior to submission of bids.

F. Safety type disconnecting switches shall be heavy duty, 600 volt industrial type with quick-make, quick-break mechanism and interlocking cover which normally cannot be opened when the switch is in the “ON” position. Switches shall be

single throw. Fusible switches shall be equipped with fuse clips to receive Bussman fuses. Switches shall have provision for padlocking in the open and closed positions. The operating handle shall be visible in either the on or off position.

G. All fused disconnect switches mounted above 6'-6" shall be hook stick operable.

H. Non-fused “pull-out” disconnects shall be allowed only for HVAC equipment serving dwelling units.

2.03 INTERIOR

A. Switch blades shall be operated by rotating shaft directly connected to the operating handle mechanism. Switch blades shall be clearly visible in the open position. All switches shall have clear shields over the incoming line lugs. Line shields shall be attached in such a way that switch blade covers or arc shields need not be removed for line installation. Line and load lugs shall be front removable and suitable for copper or aluminum, 60/75 degree wire through 200A sizes, 75 degrees C wire for 400-800A sizes.

B. Current limiting type RK1 dual element time delay fuses shall be furnished and installed as necessary; rating shall be shown on drawing.

2.04 ENCLOSURES

A. All switches shall have NEMA type 1 general purpose enclosures unless indicated otherwise on the drawings. NEMA 3R covers shall be side hinged rather than top hinged. NEMA 1 and 3R switches through 200A sizes shall tangential knockouts for conduit line up against walls. NEMA 12 enclosures through 200A sizes shall be UL Listed for conversion to NEMA 3R usage by opening a factory provided drain hole. All types of enclosures shall have metal nameplates affixed to the cover to show the switch type and rating and clearly indicate “ON” and “OFF” direction of handle movement. Provide hubs on all NEMA 4, 4X, or 3R type disconnects.

B. Provide manufacturer’s standard factory applied finish unless otherwise indicated.

C. Provide phenolic engraved nameplate for disconnect switches.

2.05 CONTROL POLE

A. Where required a direct action interlock or control pole shall be affixed to the switch base in such a manner as to operate positively and only with the opening and closing of the switch power poles.

2.06 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Locate disconnect switches to provide working clearance and full accessibility as required by the National Electrical Code.

B. Mounting and Support

1. Mounting
    a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. A 1.5-inch minimum diameter round washer shall be used between head of screw or bolt and enclosure.
    b. Enclosure shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified. Mount with operating handle at 60" AFF, unless other height is indicated.
    c. Attach enclosure directly to masonry, concrete, or wood surfaces.
    d. Mounted enclosure on metal channel (strut), which is connected to structure with fastening device.
    e. Where enclosure is not indicated on a wall or structure, construct a metal channel (strut) free standing frame secured to floor, pad, or other appropriate building structure.

C. Do not splice conductors in enclosure. Where required install junction box or wireway adjacent to enclosure and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the conductors and cables section of the Specifications and do not exceed.

3.03 CONNECTIONS

A. Install equipment grounding connections for switches with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

B. Touch up paint all scratched or marred surfaces with factory furnished touch up paint of the same color as the factory applied paint.

END OF SECTION

SECTION 26 28 18

ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 26 00 00 - Electrical General.

1.02 WORK INCLUDED

A. The work required under this section of the Specifications consists of installation of enclosed circuit breakers up to 800 amps for use on systems 600 volts and below as indicated on the drawings. This Section includes individually mounted enclosed circuit breakers used for the following:

1. Service disconnecting means.
2. Feeder and branch-circuit protection.
3. Motor and equipment disconnecting means.

B. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install enclosed circuit breakers, complete, as indicated on the Drawings and as specified herein.

C. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.03 SUBMITTALS

A. Product Data: For each type of circuit breaker accessory and component indicated, include dimensions and manufacturer’s technical data on features, performance, electrical characteristics, ratings, and finishes.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA AB 1, NEMA KS 1, UL 98, NEMA Standards Publication AB1-1975 and Federal Specifications W-C-375B classifications.

C. Comply with NFPA 70.

1.05 COORDINATION

A. Coordinate layout and installation of circuit breakers and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer of enclosed circuit breakers shall be Cutler-Hammer, General Electric, Siemens or Square D Company.

2.02 CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.

2.03 ENCLOSURES

A. NEMA 1 enclosures shall be fabricated from sheet steel with ANSI 49 gray baked enamel finish. Knockouts shall be provided in enclosures for circuit breakers through 225A frame sizes. Enclosures shall be provided with a means to padlock the circuit breaker in the OFF position.

B. NEMA 3R enclosures shall be fabricated from galvanically treated steel with ANSI 49 gray baked enamel finish. Enclosures for circuit breaker through 225A frame sizes shall have provisions for interchangeable conduit hubs. Enclosures shall be provided with a means to padlock the plate-type cover closed.

C. Provide manufacturer’s factory applied finish unless otherwise indicated.

D. Provide phenolic engraved nameplate for circuit breakers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed circuit breakers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Locate enclosed circuit breakers to provide working clearance and full accessibility as required by the National Electrical Code.

B. Mounting and Support

1. Mounting
    a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. A 1.5" minimum diameter round washer shall be used between head of screw or bolt and enclosure.
    b. Enclosures shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified. Mount with operating handle at 60" AFF, unless other height is indicated.
    c. Attach enclosure directly to masonry, concrete, or wood surfaces.
    d. Mounted enclosure on metal channel (strut), which is connected to structure with fastening device.
    e. Where enclosure is not indicated on a wall or structure, construct a metal channel (strut) free standing frame secured to floor, pad, or other appropriate building structure.

C. Do not splice conductors in enclosure. Where required install junction box or wireway adjacent to enclosure and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the conductors and cables section of the Specifications and do not exceed.

3.03 CONNECTIONS

A. Install equipment grounding connections for circuit breakers with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

B. Touch up paint all scratched or marred surfaces with factory furnished touch up paint of the same color as the factory applied paint.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTIVE DEVICES (SPD)

PART 1 - GENERAL

1.01 DESCRIPTION

A. These specifications describe the electrical and mechanical requirements for a hybrid high-energy power conditioning filter incorporating surge protective devices and high-frequency electrical line noise filtering. The specified unit shall provide effective high-energy surge protection, surge current diversion, high-frequency attenuation, and line control in ANSI/IEEE C62.41.1-2002 environments connected on the load side of the facility's meter or main overcurrent device. The unit shall be connected in parallel with the facility's wiring system.

1.02 QUALITY ASSURANCE

A. The requirements of the following standards shall become a part of this Specification by reference:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41.1-2002, C62.41.2-2002, and C62.45-2002)
2. Canadian Standards Association (CSA)
3. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
4. National Electrical Manufacturers Association (NEMA)
5. National Fire Protection Association (NFPA 70 (NEC), 75 and 78)
6. Underwriters Laboratories Inc. (UL 1449 3rd Edition and 1283)

The unit shall be UL and cUL 1449 3rd Edition Listed as a Surge Protective Device.

B. Acceptable Manufacturers

1. Current Technology
2. Thor Systems
3. Emerson/ADT

C. Testing: The unit shall be thoroughly factory-tested before shipment. Testing of each unit shall include, but shall not be limited to, quality assurance checks, MCOV and clamping voltage verification tests.

D. Warranty: The manufacturer shall provide a minimum 5-year warranty from date of shipment against failure when installed in compliance with applicable

national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

E. Submittal Documentation: Documentation of unit's UL 1449 3rd Edition Voltage Protective Rating (VPR) shall be included as required product data submittal information. Manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41.1-2002, C62.41.2-2002, and C62.45-2002 Guidelines. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the specified unit. Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS REQUIREMENT

A. The unit shall provide all modes of protection: line to neutral, line to ground, and neutral to ground.

B. High Frequency Tracking Filter: The unit shall include a UL1283 high-frequency extended range tracking filter. The filter shall reduce fast rise-time, high-frequency, error producing transients and electrical line noise to harmless levels, thus eliminating disturbances which may lead to system upset.

C. Unit Status Indicators: The unit shall include solid-state, long-life, externally mounted LED visual status indicators that indicate the status of MOV fusing.

D. Transient Counter: Front cover mounted transient counter (LCD or LED) shall totalize surges for all modes.

E. Nominal discharge current rating shall be I_n 20 kA.

F. Minimum SPD fault current ratings shall be 100Kaic.

PART 3 - APPLICATIONS

3.01 SERVICE ENTRANCE/MAIN DISTRIBUTION APPLICATIONS

A. The following table will indicate appropriate model numbers based on the electrical system ampacity. Surge current ratings are based on the Site Shield Risk Assessment Spreadsheet (TSI 067 3gSSH/r3).

B. SPDs connected to service equipment shall be listed as a type 1 SPD per UL1449 3rd Edition and shall have integral disconnect switch, and shall be connected to bus on the load side of the main switch.

SERVICE ENTRANCE/MAIN DISTRIBUTION APPLICATIONS					
Manufacturers' Models			Electrical System Ampacity @ SPD Install Point	Surge Protection (kA)	
Current Tech	Thor Systems	ASCO		Per Mode	Per Phase
TG 300	TSrc 300	560 75	4000 – 6000A	300	600
TG 250	TSrc 250	560 50	2000 – 3000A	250	500
TG 200	TSrc 200	560 40	1200 – 1600A	200	400
TG 150	TSrc 150	560 32	600 – 1000A	150	300
TG 100	TSrc 100	560 25	125 – 400A	100	200

3.02 PANELBOARDS AND BRANCH PANEL APPLICATIONS

A. As indicated on the Drawings, provide a panelboard with externally mounted SPD with high-frequency filtering per requirements listed in this specification. Provide number of breakers, voltage/phases as indicated on the Drawings. SPD shall physically connect to the top or bottom of panelboard allowing for SPD to be repaired or replaced without opening the dead front of the panelboard.

B. SPDs connected to Panelboards or Branch Panels shall be listed as a type 1 or type 2 SPD per UL1449 3rd Edition and shall be circuit breaker connected.

C. The following table indicates appropriate model numbers based on the electrical system ampacity. Surge current ratings are based on Site Shield Risk Assessment Spreadsheet (attached #TSI 067 3gSSH/r3). SPDs connected to Panelboards and Branch Panels shall be listed as a type 1 or type 2 SPD per UL 1449 3rd Edition and shall be 30 Amp circuit breaker connected.

PANELBOARDS AND BRANCH PANEL APPLICATIONS					
Manufacturer/Model Nos.			Electrical System Ampacity @ SPD Install Point	Surge Protection (kA)	
Current Tech	Thor Systems	ASCO		Per Mode	Per Phase
EGPE2 150	TSnc 150	440 P30	600A	150	300
EGPE2 100	TSnc 100	440 P20	125 – 400A	100	200
EGPE2 60	TSnc 050	440 P10	Up to 100A	50	100

PART 4 - EXECUTION

4.01 INSTALLATION

A. Install wiring connection to distribution system as indicated on the Drawings. Wiring length should be kept to an absolute minimum (3' or less) and be as straight as possible.

B. Wire sizes to Service Entrance/Main Distribution SPD should be 4#6, 1#6 G - 1" conduit.

C. Wire sizes to Panelboard and Branch Panel SPD should be as indicated 4#10, 1#10G – ¾" conduit.

END OF SECTION

SECTION 26 51 00

LIGHTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the lighting system requirements.

B. All fixtures shall be current source, provided with lamps ready to use.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to another division for the ceiling systems.

B. Lighting system shall be coordinated with the ceilings.

1.03 SUBSTITUTIONS/VALUE ENGINEERING/PRICING

A. Substitution/value engineering requests shall be accompanied by complete manufacturer's data with model numbers, cut sheets with options indicated, and a full photometric report. For exterior lighting, a computer generated point-by-point calculation shall be provided.

B. All substitution requests shall be submitted in completion to Engineer at least 10 days prior to bid date.

C. Pricing for lighting fixtures shall be separate from pricing for lighting controls (occupancy sensors, relay controls, dimming).

PART 2 - PRODUCTS

2.01 BALLASTS

A. All fluorescent lamp ballasts shall be low-loss, high power factor Class "P," with "A" sound rating and shall bear UL and CBM certifications. Ballast case temperature shall not exceed 90 degrees C.

B. All fluorescent fixtures shall be equipped with program-start ballasts. Multi-lamp ballasts shall be parallel-wired.

C. Fluorescent fixtures located in an outdoor environment shall be equipped with a minimum 0°F cold temperature ballast.

D. Linear and compact fluorescent lamp ballasts shall be electronic by Advance, General Electric, Osram Sylvania, or Universal.

E. All HID lighting fixtures shall have a high power factor, regulated output ballast provided by the fixture manufacturer, pre-wired with a glass tube fuse holder and fuse on each primary hot lead.

F. Electronic driver for LED fixtures shall include the following:

1. Rated for a minimum 50,000 hours of life
2. Class A sound rating
3. Total Harmonic Distortion: 15% or less

2.02 LAMPS

A. Fluorescent lamps shall be energy saving type, 3,500 degrees K, CRI 75, of size and wattage as scheduled on the Drawings, unless noted otherwise on Light Fixture Schedule. They shall be General Electric or equal as manufactured by Sylvania or Philips unless indicated otherwise on Drawings. Lamps shall have a rated life of 20,000 hours minimum at three (3) hours per start.

B. Incandescent lamps shall be of type, size and voltage as scheduled on the Drawings. Lamps shall be of the extended service type with a rated life of 2,500 hours. Reflector lamps (R and PAR) shall have a rated life of 2,000 hours for the standard type and 4,000 hours for the “Quartz” or “Krypton” types. Quartz lamps shall be clear with a rated life of 2,000 hours.

2.03 LIGHTING FIXTURES

A. Letter designations beside outlet symbols on Drawings correspond to letter designations in Lighting Fixture Schedule.

B. Recessed incandescent fixtures, where used in an insulated ceiling, shall be equipped with thermal protection and shall bear the UL Label indicating the suitability for such use.

C. Lens material for recessed fluorescent fixtures shall be 100% virgin acrylic, 0.125" thick in a square prism pattern similar to KSH-K-12 or as scheduled in Lighting Fixture Schedule.

D. Site lighting poles shall meet or exceed the local wind loading requirements of authority having jurisdiction.

E. Concrete pole bases shall be required for site lighting poles.

F. Recessed lighting fixtures installed in the building thermal envelope (e.g. attic) shall be IC rated and labeled with enclosures that are sealed and gasketed to limit air leakage between conditioned and non-conditioned spaces.

G. Recessed lighting fixtures that penetrate the membrane of a rated ceiling/floor assembly shall be either listed and labeled, or installed within an enclosure, so that the ceiling rating is maintained. Rated enclosures shall be by Fire Rated Product Specialties (FRPS) or approved equal.

H. All linear fluorescent lighting fixtures (with double-ended lamps) shall have a factory-installed, concealed disconnecting means for each ballast.

2.04 LED LUMINAIRES

A. UL or ETL Listed and labeled

B. Minimum 80CRI

C. 5 Year warranty minimum

D. Tested to LM-79, LM-80 and TM-21 standards

E. Lumen Maintenance: 70% lumen output for 50k hours

F. Power Factor: 0.9

PART 3 - EXECUTION

3.01 LIGHTING FIXTURES

A. Provide lighting fixtures at all locations indicated by distinctive symbols or notes on the Drawings.

B. Lighting fixtures shall be secured to ceiling grid with clips or screws and two #12 steel wires mounted to opposite corners of light fixture secured to structure.

C. Locations of lighting fixtures on the electrical drawings are approximate. Refer to Architectural reflected ceiling plan for actual locations of fixtures and mounting heights.

D. Lighting fixtures installed in plaster and stucco ceiling shall have plaster frame and shall be of the flanged type.

E. Fixtures recessed in concealed-spline tile and in gypsum board ceilings shall be flanged.

F. Surface or recessed fixtures in or on plastered ceilings shall be supported from pieces of support channel spanning across the main supporting channels and shall not depend on the metal lath for support.

G. Each recessed lighting fixture shall have a trim to match the type of ceiling (exposed grid, metal panel, etc.) in which it is being installed, except where noted otherwise on the plans.

H. Each lighting fixture recessed in a concrete wall shall have a junction box or wiring compartment provided inside the fixture housing. Provide conduit access into the fixture concealed.

END OF SECTION

SECTION 28 30 00

TWO-WAY EMERGENCY COMMUNICATION SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Section 26 00 00 - Electrical General shall be considered a part of this section and shall have the same force as if printed herein in full.

B. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and/or on the Drawings.

1.02 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

B. The work shall include, but not be limited to, the following:

1. Furnish and install communication base system, call boxes, graphics, labeling and all associated wiring.

1.03 QUALITY ASSURANCE

A. Coordination: Coordinate installation with architectural and structural features, equipment installed under other sections of the Specifications.

B. Components and installation shall be in accordance with the requirements of the International Building Code, NFPA, and ADAAG.

1.04 SHOP DRAWINGS

A. Shop drawings shall be submitted and shall contain the following:

1. Specification sheet/sheets of technical data on each hardware component
2. Specification sheet(s) on wiring to be utilized
3. One-line schematic riser diagram made specifically for this job
4. Calculation for sizing batteries and power supplies
5. Sequence of operation for the entire system

6. Verification of central supervising station (UL Certified)
7. Equipment and service warranty
8. Scaled floor plans showing device locations and wire routing

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Two-Way Communication System Manufacturer

1. Rath Area of Refuge
2. Approved Equal

2.02 SYSTEM COMPONENTS

A. The Base Station shall be installed in location shown on the drawings, and shall have the following components:

1. Stainless steel or powder-coated steel housing, red coil cord emergency Handset, 120vac powered, with battery back-up power for 4 hours operation of any call box and base station.
2. Audible and visual indicator that a call box has been activated.
3. 24vac power supply model capable of supplying power to a minimum of 40 call boxes.

B. Each Call Box shall be installed in location shown on the drawings, and shall have the following features:

1. Must comply with Americans with Disabilities Act (ADA)
2. Hands-free speakerphone with an LED to indicate status of call
3. Programmable for specific location message of the Call Box. This allows rescue personnel to know the location of the activated Call Box.
4. Braille faceplate located no higher than 48" for front reach and 54" for side reach above ground level to ensure conformance with the ADA requirements.

2.03 SYSTEM FEATURES

A. Operational Communication Features

1. Call Box shall be hands-free operable and be a push-button-once to talk system. Once the button has been pushed, the Call Box will call the Base Station. If no answer at the Base Station, it will automatically call preprogrammed emergency numbers. The Call Box must be capable of being programmed with up to 5 emergency numbers to activate two-way off-site person-to-person voice communications.

2. Call Box shall have Location Message capability. Call Box must have a minimum 18 second recordable message capability, programmable to play 1 or 2 times. Call Box shall notify called party of the location of the call upon being received at the emergency dispatch center.
3. Call Box shall be capable of allowing the called party to replay the Location Message if necessary to ensure an understanding of the caller location.
4. Once call has been made (button pushed), the call can be terminated only by the called party.
5. Call Box must have a red LED that will light up upon push of the button. The light shall be a solid color when the Call Box is activated, and will flash when call has been answered.
6. Call Box must be capable of being programmed and reprogrammed on-site and remotely.
7. Operating temperature of call box shall be between -40 deg. F to 150 deg. F.
8. Call Box shall have EEPROM memory to protect programming.

B. Graphics and Labeling

1. Base Station shall have appropriate wording to indicate the location of each call box, located adjacent to the LED associated with each call box.
2. Call Box graphics must include “Help Phone,” international phone symbol and raised Braille lettering.

PART 3 - EXECUTION

3.01 MONITORING

A. Contractor shall coordinate with the owner to arrange for an off-site monitoring agency associated with this communication system.

3.02 CABLING

A. Cabling for two-way communication system shall meet the applicable requirements for pathway survivability. Cabling installation shall consist of one or more of the following:

1. 2-hour fire-rated circuit integrity (CI) cable
2. 2-hour fire-rated cable system
3. 2-hour fire-rated enclosure or protected area

3.03 TESTING

A. Prior to completion, contractor shall test the functionality of all call boxes, both for connection to the base station, as well as for successful communication with off-site monitoring agency.

3.04 WARRANTY

A. System shall be warranted for a period of three years.

END OF SECTION

SECTION 28 31 11

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers the complete installation of a new automatic fire alarm system, as well as necessary materials, labor, calibration, testing and training.

B. The complete installation shall be in compliance with NFPA 70, 72, 101 (Life Safety Code) and NEC Article 760. The installation shall also comply with state and local ordinances, as well as the Americans with Disabilities Act (Public Law 101-336).

C. All equipment supplied shall be listed for the purpose and area in which it is used and installed in accordance with any instructions included in its listing.

D. All equipment must be new and bear the UL (Underwriters Laboratories Inc.) Label.

1.02 SHOP DRAWINGS

A. Fire alarm shop drawings shall contain the following:

1. Specification sheet(s) of technical data on each hardware component
2. Specification sheet(s) on wiring to be utilized
3. One-line schematic riser diagram made specifically for this job
4. Calculation for sizing batteries and power supplies
5. Sequence of operation for the entire system
6. Copy of vendor's NICET fire alarm certificate (level III or higher)
7. Verification of central supervising station (UL Certified)
8. Equipment and service warranty
9. Scaled floor plans showing fire alarm device locations and wire routing

1.03 ACCEPTABLE MANUFACTURERS

A. Products of the following manufacturers which comply with these specifications are acceptable:

1. Honeywell – Notifier/Gamewell-FCI/Farenhyt
2. Siemens
3. E.S.T.

4. Johnson Controls - SimplexGrinnell

1.04 STORAGE AND HANDLING

A. Smoke detectors shall be covered with plastic wrapping if installed prior to the completion of painting, sanding and other work producing dust, etc.

B. The fire alarm control panel(s) shall not be installed until its designated room has been completely painted and cleaned.

PART 2 - PRODUCTS

2.01 CONTROL PANEL/SYSTEM DESCRIPTION

A. The fire alarm system shall be an electrically supervised, power limited, low voltage (24 VDC), non-coded, multiplexed, fully analog, addressable system. The fire alarm control panel shall be of modular design for ease of future system addition or modification (up to 20% additional capacity).

B. The control panel shall provide system status via an 80-character liquid crystal display and shall also have the following features:

1. Power “ON” Light Emitting Diode (LED)
2. System Reset Switch
3. System Alarm LED
4. System Trouble LED
5. Alarm Silence Display
6. Trouble Silence Display
7. Control panel shall be lockable.
8. Normally open and normally closed sets of contacts for control of remote equipment/devices.

C. Batteries shall be mounted in space provided in the fire alarm control panel. Control panel shall include automatic charging circuit to maintain battery/batteries in charged condition. Batteries may be lead acid or nicad; charging circuit shall match battery type.

D. The battery/batteries shall have sufficient ampere-hour capacity to operate the system under normal supervisory conditions with A.C. power disconnected for 24 hours, and at the end of that period to operate all alarm notification appliances for 5 minutes. For calculation purposes, all audible devices shall be tapped at a minimum of one (1) watt.

E. The battery/batteries shall have sufficient ampere-hour capacity to operate the system under normal supervisory conditions with A.C. power disconnected for 24

hours, and at the end of that period to operate all alarm notification appliances for 2 hours (15 minutes of evacuation alarm operation at maximum load shall be considered equivalent). For calculation purposes, all audible devices shall be tapped at a minimum of one (1) watt.

F. The system shall operate from one (1) 20-ampere, single-phase, 3-wire 120 V.A.C. circuit. The circuit breaker shall be labeled "Fire Alarm Circuit Control."

G. The fire alarm system shall respond to a fire emergency as follows:

1. Smoke damper control and automatic shutdown of HVAC air systems shall occur upon activation of respective duct smoke detector.
2. Automatic audible/visual notification (via horns/strobes) shall be provided upon activation of a flow switch, manual station, or area smoke detector.
3. Automatic audible/visual notification (via speakers/strobes) shall be provided upon activation of a flow switch, manual station, or area smoke detector. Automatic alarm notification shall be distributed [throughout the facility as a general alarm] [selectively to the incident floor, the floor above, and floor below]. Each stairwell shall be provided with a minimum of one (1) speaker for every three (3) floors.
   Pre-recorded voice message capability shall be provided for automatic transmission to building occupants during alarm conditions. A standard evacuation message shall be provided under this Contract. The message player must be capable of transmitting a customized message of up to 3 minutes long. A self-contained speaker will be provided to allow testing of the message without disturbing the occupants of the facility. The system shall be configured to allow selective voice paging. If any manual control switches are activated, the control panel operator shall be able to make announcements via a push-to-talk paging microphone over the preselected speaker circuits (where applicable).
4. Signal output to the UL Listed central station (for fire system reporting) shall be installed in accordance to the project specifications and drawings.
   a. Basic Performance:
      1) The Communicator will communicate to GSM networks in the area including 2G, 3G and 4G. The multi-GSM platform technology automatically detects and chooses the best network in the area based on signal strength and immediately self-adjusts for operation.
      2) Supervision of communication path with be monitored and automatically tested per the NFPA requirements listed below based on local NFPA adoptions:
         NFPA72 2010 GSM Single Path (cellular only) 5 minutes
         NFPA72 2013 GSM Single Path (cellular only) 1 hour
      3) Diagnostic LEDs: Signal strength and status indications.
      4) All circuits shall be power-limited, per UL864 requirements.

5) In areas where the GSM network signal strength is poor or not allowed by the AHJ, a D.A.C.T. communication device (or similar UL Listed "fire" device) shall be provided in lieu of cellular communicator. Provide and install 3/4" conduit from the panel to the main telephone backboard.

5. Signal output to the UL Listed central station (for fire system reporting) shall be installed in accordance to the project specifications and drawings. Communicator shall be in the FACP located in [e.g. clubhouse] building. All remote building FACPs shall be connected to the communicator via fiber optic loop. Fiber shall be installed between buildings in underground conduit with tracer wire.
   a. Basic Performance:
      1) The Communicator will communicate to GSM networks in the area including 2G, 3G and 4G. The multi-GSM platform technology automatically detects and chooses the best network in the area based on signal strength and immediately self-adjusts for operation.
      2) Supervision of communication path with be monitored and automatically tested per the NFPA requirements listed below based on local NFPA adoptions:
         NFPA72 2010 GSM Single Path (cellular only) 5 minutes
         NFPA72 2013 GSM Single Path (cellular only) 1 hour
      3) Diagnostic LEDs: Signal strength and status indications.
      4) All circuits shall be power-limited, per UL864 requirements.
      5) In areas where the GSM network signal strength is poor or not allowed by the AHJ, a D.A.C.T. communication device (or similar UL Listed "fire" device) shall be provided in lieu of cellular communicator. Provide and install 3/4" conduit from the panel to the main telephone backboard.
6. Smoke door release (where applicable) shall occur generally throughout the entire facility.
7. Tamper switch operation shall cause a supervisory signal to indicate audibly and visually at the control panel.
8. Activation of elevator lobby or elevator equipment room smoke detector shall cause immediate, non-stop return of all respective elevators to designated discharge level. Provide and install 3/4" conduit from control panel to elevator controller(s).
9. Operation of stairwell pressurization fans and/or smoke exhaust fans via area smoke detectors at each entrance to stairwell(s) and/or within affected smoke zones.
10. Notification at control panel upon activation of kitchen hood fire suppression system.
11. Fire pump status shall be displayed for the following conditions:
    a. Power failure
    b. Pump operation

c. Phase reversal
d. Alternate power source

12. Fire pump normal power availability, fire pump normal source phase reversal, fire pump normal source loss of phase and fire pump run status shall be monitored. Loss of normal power, phase reversal and loss of phase shall annunciate as trouble, fire pump running shall annunciate as a supervisory alarm.
13. Fire pump alternate power source availability, fire pump alternate source phase reversal and fire pump alternate source loss of phase shall be monitored. Loss of alternate power source, alternate source phase reversal and loss of alternate source phase shall annunciate as trouble.
14. The following conditions of emergency generator(s) shall be monitored by the fire alarm system:
    a. Generator running
    b. Generator fault
    c. Generator switch in non-automatic position
15. Controls for unlocking stairwell doors simultaneously.
16. Heat detectors shall be installed in sprinklered elevator machine rooms and hoistways to activate shunt trip devices for power to elevator motors. Heat detectors shall be placed within 24 inches of each sprinkler head, and shall have a temperature threshold that is lower than the sprinkler heads. Upon activation of the heat detector there shall be a delay in the activation of the power shunt trip. This delay shall be the time necessary for the elevator cab to travel from the top of the hoistway to the lowest recall level.
17. Where elevators are designated as fire service access elevators, or for use in occupant evacuation, the following conditions shall be monitored by the fire alarm system:
    a. Availability of main and emergency power to operate the elevator(s), elevator controller(s), and machine room (if provided) ventilation.
    b. Status of the elevator(s), including location within the hoistway, direction of travel, and whether they are occupied.
    c. Temperature and presence of smoke in associated lobbies and machine room.
18. Fire alarm system shall electrically supervise the signal boosters and batteries of the Emergency Responder Radio Coverage System (where applicable).

H. Supervision

1. Fire alarm pathways shall be Class B.
2. Pathway survivability for notification appliances shall be as follows:
    a. Pathways shall be protected from the point at which they exit the control unit until they enter the evacuation signaling zone they serve and shall meet survivability requirements Level 0 or 1.

b. Pathways shall be protected from the point at which they exit the control unit until they enter the evacuation signaling zone they serve and shall meet survivability requirements Level 2 or 3.

3. Each independently supervised circuit shall include a discrete panel readout to indicate disarrangement conditions per circuit.
4. Power failures, opens, or grounds shall be audibly and visually indicated at the control panel and the remote annunciator (where applicable). A green "power on" LED shall be displayed continuously while incoming power is present.
5. Power wiring to sprinkler pipe heat tracing shall be supervised by fire alarm system.

I. Provide remote annunciator panel with 80-character liquid crystal display, audible signal and alarm/trouble lights.

J. Fire Department Communication System

1. Provide a two-way voice communication system between the Fire Control and Emergency Phone Jacks. All wires between the Fire Control and remote units shall be continuously supervised. Any fault which occurs shall be reported visually and audibly at the Fire Control.
2. A master telephone control module shall be furnished to provide processing of all two-way communication functions. This module shall include an audible sonalert for call and trouble signaling, a trouble silence switch with ring back, a trouble indication and supervising monitor circuit.
3. A black master telephone handset with flexible-coiled self-winding five-foot cord shall be provided and recessed within a protective panel-mounted enclosure at the command center. This enclosure shall also provide mother board locations for the phone control and flasher/busy tone oscillator.
4. Provide five (5) firefighter's telephone handsets for use with the firefighter's telephone jack stations. The telephone handsets shall be red in color and have a 5 ft. (1.3m) coiled cord.
5. At a minimum provide one (1) line (talk) circuit per floor, one (1) per elevator cab, one (1) for emergency power room, and one (1) for the fire pump room. Each line (talk) circuit shall be monitored for shorts, opens and grounds. Each line module shall contain a "call" and "trouble" indication and a two-position switch to enable two-way voice communication between remote and master phones. Circuiting shall be horizontal by floor for stairwell and elevator lobby devices.

K. Underground Signaling Line Circuits

1. All underground signaling line circuits (SLC) routed exterior to building shall be fiber optic cabling. Cabling shall be installed in conduit with tracer wire.

L. Transient Voltage Surge Suppression

1. Approved manufacturer/model: DITEK DTK-TSS1.
2. Provide all necessary components to provide complete protection of the control panel, data, signal, and dialer circuits/connections.
3. Surge protection shall be provided for any copper NAC, IDC and SLC circuits which are installed underground outside of a building.
4. All underground pathways entering the building to be protected by surge protectors on both ends and properly grounded.
5. Modules shall be mounted in NEMA 12 steel enclosure adjacent to FACP.

2.02 FIELD DEVICES

A. Manual Stations: Semi-flush, addressable, double action type. Station shall be constructed of high impact red polycarbonate.

B. Area Smoke Detectors: Smoke detectors shall be of the analog, addressable, photoelectric type. A pulsed diode pilot lamp, visible from the floor, shall be provided to indicate alarm condition or component failure. Diode pilot lamp may be pulsed diode type for normal and steady for alarm trouble indication. Detectors shall be self-supervising for component failure as well as line failure. Detector failure or removal of detector shall initiate (zone) trouble signal. Detector shall be capable of monitoring 900 square feet of unobstructed area with spacing not to exceed 30 feet on center. Smoke detectors shall be ceiling mounted and shall be interconnected into alarm system to function in same manner as the manual station. Detectors shall report analog level of smoke/dirt to panel.

C. Duct Smoke Detectors: Detectors shall be of the analog, addressable, photoelectric type. The unit shall consist of a detector and an air sampling assembly housed in a casting designed for duct mounting. The sampling tubes shall extend completely across the duct. Detectors shall report analog level of smoke/dirt to panel. Where detector LEDs are concealed, not easily observable, or greater than 10' above floor, detectors shall have remote LED alarm indicators in a nearby observable location for alarm identification. Each LED shall be labeled to identify location of duct smoke detector.

D. Audible/Visual Devices: Audible/visual devices shall be horns with flashing visual appliances with the word “FIRE” written on the lens. The horns shall produce at least 15 dBa above ambient noise level. Audible and visual devices (including the combination device) shall utilize a 4" electrical backbox. Visual devices shall be multi-candela, field-selectable, with a constant flash rate of one (1) flash per second. The device color shall be white.

E. Audible/Visual Devices: Audible/visual devices shall be speakers with flashing visual appliances with the word "FIRE" written on the lens. The speakers shall produce at least 15 dBa above ambient noise level. Audible and visual devices (including the combination device) shall utilize a 4" electrical backbox. Visual devices shall be multi-candela, field-selectable, with a constant flash rate of one (1) flash per second. The device color shall be white. A separate pair of conductors shall be routed from the nearest NAC panel to every speaker within a dwelling unit for a future combination speaker/strobe device.

F. Any audible device installed in a sleeping room, including living rooms, shall have a low-frequency sounder approved for fire protective service, and shall be listed to UL 464. The device shall be powered from a notification appliance circuit output and shall operate on nominal 12 or 24 volts (includes fire alarm panels with built in sync). All notification appliances shall be backward compatible.

G. Any visual device in a sleeping area shall be minimum 110 candela, unless noted otherwise.

H. Addressable relays shall be provided as required to accomplish all mechanical systems and other related control functions.

I. Addressable input monitoring devices shall be provided as required to monitor existing water flow, tamper switch, and other devices.

J. Heat detectors shall be addressable, fixed temperature type rated at 135 degrees F, unless noted otherwise on drawings. Where heat detectors are used to shut down elevator power prior to sprinkler operation, the detector must have a faster response time than the sprinkler head, and must be mounted within 2 feet of each sprinkler head. Power required to activate shunt-trip breakers for elevator motors shall be monitored via supervisory wiring to the fire alarm control panel.

K. Fire phone jacks shall mount on stainless steel single gang plates labeled in red "Fire Emergency Phone." Jacks shall be installed within stairwells, at elevator lobbies, and in fire pump room.

L. Smoke Detectors with Integral Sounder: Detectors in each sleeping room and living room shall be addressable, system-connected with built-in evacuation horn and power-on indicator. Where more than one is installed in a suite or unit, activation of one detector shall trigger all horns in that suite or unit.

M. 120V smoke alarms in each sleeping room and living room shall be interconnected to the fire alarm system via a monitor/control module. Refer to drawing detail for more information.

N. Monitoring of remote fire protection valves on site (if applicable) shall be accomplished via fire alarm system connection.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall obtain approval from Owner as to the final and exact location of each control panel and remote annunciator prior to installation.

B. All wiring shall be suitably protected from damage. Wiring shall be routed within conduit where installed in the following areas:

1. Underground
2. Damp and wet locations
3. Where exposed on interior walls
4. For all input and output signal wiring for smoke exhaust (including stairwell pressurization) equipment
5. Where concealed in a wall or inaccessible ceiling

C. All wiring installed exposed within a plenum shall be UL Listed accordingly. Plenum rated cable shall be tied to the building structure at approximately 6'-0" on center using cable ties.

D. Conduit sleeves with bushings shall be installed for fire alarm cabling that passes through walls and floor assemblies. Seal the opening around the conduit and the hole in the conduit with a UL Listed fire rated sealant as required.

E. All detection and control wiring to mechanical smoke control systems shall be fully enclosed within continuous raceways.

F. Provide necessary programming to accomplish the indicated system operation and control functions.

G. All conduit, control wiring, power wiring, relays, and other equipment and devices required to form a complete and operational system shall be provided as part of this Contract.

H. All wiring requirements for shielding certain conductors from others or routing in separate raceways shall be as recommended by the manufacturer.

I. The Fire Alarm Contractor shall coordinate all electrical branch circuit identification requirements listed in NFPA 72, Chapter 10 with the Electrical Contractor.

3.02 WARRANTY

A. Equipment, materials, workmanship and system performance incorporated into the work shall be guaranteed for a period of one (1) year from the time the Owner receives beneficial use of the fire alarm system and the acceptance tests herein specified have been satisfactorily completed. Any defects due to faulty materials, methods or installation or workmanship within this period shall be promptly repaired or replaced.

B. Vendor shall provide pricing for system inspections for a period of four (4) additional years after the initial 12-month warranty as a bid alternate to the Owner. Provide inspections per NFPA 72 and NFPA 101.

C. Spare Parts: Provide the following spare equipment items to the Owner upon project completion:

1. Addressable modules: 2
2. Smoke detectors: 2
3. Manual stations: 2
4. Duct mounted smoke detectors: 1
5. Audible/visual devices: 4

3.03 TESTING AND CERTIFICATION

A. Testing and certification of the life safety system per NFPA 72 shall be as required by the Fire Marshal and Engineer. The Contractor shall be responsible for identifying the required testing, coordinate scheduling, and conducting the test necessary to achieve occupancy certification, and assurance of complete system operation. The Contractor shall submit proof of complete system operation signed by the Fire Marshal to Engineer and Owner.

B. Contractor shall notify the Owner's representative in writing that the Owner is responsible for hiring a monitoring agency for remote supervision of the fire alarm system.

END OF SECTION

SECTION 313116

TERMITE CONTROL

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Below grade soil treatment for termite control.

1.2 SUBMITTALS

A. Certification: Furnish certification that application was made at specified concentrations and using specified methods and materials, jointly signed by applicator and Contractor.

1.3 QUALITY ASSURANCE

A. Materials: Comply with EPA requirements.
B. Applicator: Licensed for termite control by authorities having jurisdiction.

1.4 DELIVERY, STORAGE AND HANDLING

A. Follow requirements of applicable codes, standards, rules, and regulations.
B. Properly protect containers from accidental opening or use.

1.5 PROJECT CONDITIONS

A. Do not apply when surface water is present.

1.6 SCHEDULING

A. Apply soil treatment prior to placing vapor barrier.

1.7 WARRANTY

A. Provide **5** year warranty (renewable thereafter in one year increments with annual inspection of all structures) against invasion or propagation of subterranean termites, damage to building or building contents caused by termites: Warrant to include repairs to building and building contents so caused with no dollar limitation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Water based solution, uniform in composition, synthetically dyed to permit visual identification of treated soil, of a generic chemical composition approved for use by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 APPLICATION

A. Apply treatment to soil at building areas at following minimum rates:
   1. Beneath floor slabs: 1 gallon per 100 square feet.
   2. Inside of grade beams: 112 gallon per linear toot in 1 foot wide strips.
   3. Outside of grade beams: ½ gallon per linear foot In I foot wide strips, per foot of depth from bottom of beam to grade.
   4. Slab penetrations: Saturate not less than 1 foot in depth and 2 feet around penetration.

B. Prevent spillage or runoff onto adjacent non treated areas.

END OF SECTION