CONSTRUCTION DOCUMENTS

Cancer Specialists of North Florida
Fleming Island Cancer Treatment Facility

Fleming Island, Florida

GS&P Project No. 29551.01

October 25, 2013

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END OF SEALS PAGE 00 0107

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes general requirements of the Contract.

1.2 GENERAL REQUIREMENTS

A. General: The Contractor shall have use of premises for construction operations, including use of project site, during construction. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project and conditions of any easement or right-or-way occupancy permits. Coordinate staging with Owner; existing CBO parking area will be off-limits.

B. Prior to commencement of Work, the Contractor shall review the construction site with the Owner's representative to make permanent record of such existing damage as cracks, malfunctioning utility equipment and fixtures, or other similar damage. This record shall serve as a basis for determination of subsequent damage to the structures and adjacent areas due to Contractor's operations. Any damage to these structures and adjacent areas not noted in original review record shall be reported immediately to Owner. Permanent record shall include photographs and/or video graphic recording.

C. Smoking and Fire Precautions: No smoking, fire, or use of any fire- or explosion- producing tools or equipment will be permitted on the premises or at any locations where such may endanger said premises or the current operations thereon.

D. Manufacturers Qualifications: The manufacturers of all materials and equipment used must be approved by the Engineer and regularly engaged in the manufacture of the particular material or equipment for the use and service to which it will be subjected.

E. Compliance with state and local laws: Comply will all applicable requirements of state and local laws and ordinances to the extent that such requirements do not conflict with federal laws or regulations.

F. Protection of public and private property: The Contractor shall be responsible for preservation of and shall take special care in working areas to protect public and private property. The Contractor shall replace or repair at his own expense any damaged water pipes, power and communication lines, or other public utilities, roads, curbs, gutters, sidewalks, drain pipes, drainage ditches, all properties and fixtures (both permanent and temporary), and all plantings, including grass or sod on the site of the work. Leave the site in original or better condition after all cleanup work has been done.

G. Markers: Preserve all surveyed and privately owned markers and monuments; do not remove or disturb any such markers without prior approval from the Owner of the marker. Any removal and replacement of such markers shall be at the expense of the Contractor.

H. Pavement repair and/or replacement: Whenever existing asphalt is removed, backfill same and restore traffic over the disturbed area as quickly as possible by constructing a temporary eight-inch thick surface of Class A, Grade D crushed stone. Add material and otherwise

maintain such surface until the permanent pavement is restored by the Contractor or until the work is accepted.

I. Approved Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. The use of all such chemicals and the disposal of residues shall be in strict conformance with manufacturer's instructions.

J. Catalog Data for Owners: Provide duplicate complete, bound sets of a compilation of catalog data of each manufactured item of mechanical and electrical equipment used in the Work, for transmittal to the Owner before payment of more than ninety percent (90%) is made. Include descriptive data and printed installation, operating, and maintenance instructions (including a parts list for each item of equipment). Provide a complete double index as follows:
   1. List the products alphabetically by name.
   2. List alphabetically the names of manufacturers whose products have been incorporated in the work, together with their addresses and the names and addresses of the local sales representative.

K. Installation, Testing and Guarantee: Install all materials and equipment exactly in accordance with the manufacturer's recommendations. The completely installed system shall be guaranteed against any and all defects of manufacture, materials, workmanship, or installation for a period of one year from the date of Substantial Completion.

L. Operation and Maintenance of the Systems and Instruction to Owner: Where the specifications for equipment require that a factory service representative provide operation and maintenance instruction to the Owner for that equipment, this service shall be performed by prior arrangement with the Owner after and in addition to the manufacturer's instructions to the Contractor for installation and start-up. The individual performing the instructions to the Owner is to be trained and/or certified by the manufacturer as its authorized operation, maintenance, and service specialist. If the said specialist is not a regular, full-time employee of the manufacturer, the specialist's qualifications shall be submitted to the Owner for review and approval prior to scheduling the site visit for instructions to the Owner.

M. Drawings of Record: Provide and keep up-to-date a complete record set of drawings, which shall be corrected daily to show every change. Keep this set of prints at the job site, and use only as a record set. This shall not be construed as authorization for the Contractor to make changes in the approved layout without definite instructions in each case. Turn the set over to the Owner upon completion of the project.

N. Preservation of Existing Vegetation: Take reasonable care during construction to avoid damage to vegetation. Where the area to be excavated is occupied by trees, brush, or other uncultivated vegetable growth, clear such growth from the area, and dispose of it in a manner satisfactory to the Owner. Leave undisturbed any trees, cultivated shrubs, flowers, etc., situated within public rights-of-way and/or easements through private property but not located directly within excavation limits. Transplant small ornamental trees, cultivated shrubs, flowers, etc., located directly within excavation limits so they may be replaced during property restoration operations. Do not remove or disturb any tree larger than six inches (6") in diameter without the permission of the Owner. Take special precautions (including the provision of barricades and the temporary tying back of shrubbery and tree branches) for the protection and preservation of such objects throughout all stages of construction; the

Contractor will be held liable for any damage that may result to said objects from excavation or construction operations. Trim any limbs or branches of trees broken during construction operations with a clean cut, and paint with an approved tree pruning compound. Treat tree trunks receiving damage from equipment with an approved tree dressing.

O. Existing Utilities: The Contractor is to notify the Owner of all underground utilities no less than two days in advance of proposed utility interruption before beginning construction in the area. The Contractor is responsible for locating all existing utilities prior to construction and shall carefully protect from damage all utilities in the vicinity of the work at all times. The Contractor shall be responsible for repairing any utilities that were properly located and marked. If it is necessary to repair, remove, and/or replace any such utility in order to complete the work properly, do so in compliance with the rules, regulations, and approval of the particular utility involved. Any such work shall be considered incidental to the construction or repairs of utility lines, and no additional payment will be allowed therefor. Existing utilities shall remain in service at all times during construction. Contractor shall provide any temporary piping necessary to maintain utility service to existing customers.

P. The Contractor shall maintain an acceptable flow of traffic through construction areas. If a roadway must be closed in order to construct the Work, the Contractor shall notify local law enforcement, 911 call center, local school superintendent, and U.S. Postal Service, at a minimum, at least two days prior to roadway closure.

Q. Work in Right-of-Ways:
1. The Contractor shall notify the authorities having jurisdiction prior to entering and working in right-of-ways and shall be responsible for all damages resulting from said Work and for satisfying the requirements of said authorities.
2. The Contractor shall maintain a suitable and safe condition throughout the right-of-way affected by the Work and provide detours as necessary for public and private traffic.
3. Materials excavated in right-of-ways shall be hauled to a disposal site immediately and shall not be stockpiled in right-of-way.

R. Inspection of Work: The Contractor shall provide full access to the project site at all times for inspection and observation of Work by the Owner, Engineer, and agents of any local, state, or federal agency having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

3.1 OPERATION OF EXISTING UTILITIES

A. The Work shall be performed so as to cause minimum interference or interruption with the normal operation of the existing utilities. The Contractor shall plan and conduct construction sequencing operations to avoid disturbing existing utilities and equipment, except as may be provided or approved by the Engineer.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Owner-furnished products.
5. Access to site.
6. Work restrictions.
7. Specification and drawing conventions.
8. Miscellaneous provisions.

B. Related Requirements:
1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Fleming Island Cancer Treatment Facility
1. Project Location: Fleming Island, Florida, 32003

B. Owner: Cancer Specialists of North Florida, 7015 AC Skinner Parkway, Jacksonville FL 32256.
1. Owner's Representative: TBD.

C. Architect: Corie Baker, AIA, Gresham Smith and Partners, 5220 Belfort Road, Suite 100, Jacksonville FL 32256 (904) 332-6699.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. McVeigh and Mangum Engineering Inc., 9133 RG Skinner Parkway, Jacksonville FL, 32256 (904) 483-5200.
a. Mechanical – Frank Yarizadeh
b. Electrical – Tom Neilson
c. Structural – Matthew Main

E. Other Owner Consultants: The Design Build Contractor has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Civil Engineer: Ed Goodson, Principal, Goodson Nevin & Assoc., 10175 Fortune Parkway, Suite 403, Jacksonville, FL 32256, Civil Engineer has prepared the following portions of the Contract Documents:
a. Civil Engineering Drawings

F. Design-Builder: Sauer Inc.
1. Design-Builder has been engaged for this Project to provide architectural and engineering services and to serve as Project's constructor. In Divisions 01 through 33 Sections, the terms "Design-Builder" and "Contractor" are synonymous.

G. Project Web Site: A project Web site administered by Architect will be used for purposes of managing communication and documents during the construction stage.
   1. See Division 01 Section "Project Management and Coordination" for requirements for using the Project Web site.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   1. Construction of a new 17,586 square foot Outpatient Cancer Treatment Facility on a green field site in Fleming Island, Florida. The Facility will provide services for radiation and medical oncology.

B. Type of Contract:
   1. Project will be constructed under a single prime contract.

1.4 OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner Responsibilities:
   1. Provide Product Data, Shop Drawings, Samples, and other submittals to Contractor.
   2. Arrange and pay for delivery to site.
   3. Notify Contractor of scheduled delivery dates.
   4. Inspect delivered products jointly with Contractor.
   5. Submit claims for transportation damage, and replace damaged, defective, and missing items.
   6. Arrange for manufacturer warranties, inspections, and service.

B. Contractor Responsibilities:
   1. Review Owner-provided submittals for compatibility, installation, and use requirements. Notify Architect and Owner of issues that relate to coordination or scheduling.
   2. Designate scheduled delivery dates for Owner-supplied products in construction schedule as earliest possible date, unless otherwise informed by Owner.
   3. Receive, unload, handle, and store delivered products; inspect jointly with Owner for completeness and damage.
   4. Protect Owner-supplied products against loss and damage after receipt.
   5. Install and otherwise incorporate Owner-supplied products into the Work.
   6. Repair or replace items damaged after delivery.

1.5 ACCESS TO SITE

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

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and 25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
2. Cutting, capping, and reconnecting utility systems outside limits of construction shall be performed by Contractor, unless otherwise noted.
3. Conform to all laws, ordinances, permits and regulations affecting the Work on site.
4. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
5. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
   a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
6. Do not unreasonably encumber site with equipment, materials, or vehicles.
7. Return all improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed, to conditions which existed previous to starting performance under the Contract.
8. Parking for construction personnel including the use of Owner’s parking lot(s) shall be reviewed with Owner before construction start.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 7 p.m., Monday through Friday, unless otherwise indicated.
   1. Weekend Hours: no restrictions unless otherwise indicated
   2. Early Morning Hours: 7am.
   3. Hours for Utility Shutdowns: coordinate with owner

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than 7 days in advance of proposed utility interruptions.
   2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

E. Controlled Substances: Use of tobacco products and other controlled substances within the existing building or on Project site is not permitted.

F. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.7 DISPOSITION OF EXCESS AND DEMOLISHED MATERIALS

A. Project surplus or demolition materials may not be provided to Vanderbilt faculty or staff. Material shall be removed from the project site or turned over to VUMC Storage and Services at the contractor's expense.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Project Manual: The Project Manual comprises written documents for the Work in one or more volumes that include Specifications issued under the professional seals of the Architect and its consultants, and documents prepared by the Owner or other entities for which the Architect has no responsibility. The Project Manual may contain documents such as bidding requirements and information available to >> bidders >> Contractor >> that are not Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by industry standard abbreviations and as scheduled on Drawings.

1.9 MISCELLANEOUS PROVISIONS

A. No building element or system shall be installed within elevated composite slab assemblies. The assembly shall be constructed in accordance with the referenced fire-rated design test.

B. By execution of this Contract, Contractor acknowledges review of proposed details and specifications and agrees to provide warranties and bonds for products and systems specified herein, detailed on drawings and as approved as a substituted or comparable product or system in accordance with Division 01 Section "Product Requirements".

C. At the project site (in hard copy or electronic access) provide and maintain quality standards for construction and equipment for the project including, but not limited to the following:
   1. ADA/ADAAG and applicable Accessibility Code for project.
   2. Building Codes – Complete set of codes enforced for the project.
   3. Gypsum Construction Handbook.
   4. Florida Fire Prevention Code.
   5. U.L. Fire Resistance Directories.
   6. State Health Codes.

D. No material containing asbestos shall be used in the construction of this project or incorporated into the completed work. Contractor shall provide certification that the building is asbestos free at the completion of construction, as required in Division 01 Section "Closeout Procedures".

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PREPARED BY:	
CHECKED BY:	

ISSUED	**DATE**

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Requests for Information (RFIs).
   4. Project Web site.
   5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
   1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.
   4. Division 01 Section "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.2 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Project closeout activities.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      f. Indicate required installation sequences.

g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Division 01 Section "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
   2. File Preparation Format: DWG, Version 2012 , operating in Microsoft Windows operating system.
   3. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
   4. Architect will furnish Contractor individual drawing files (not Construction Documents) of the Drawings for use in preparing coordination digital data files.
      a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
      b. Digital Data Software Program: Drawings are available in AutoCAD (.dwg); Architect's standard software application and CAD file conventions for the project.
      c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. RFIs will be accepted and processed by the Architect only on Contract Documents prepared by the Architect or its consultants that are sealed and have been issued for construction.
   1. Requests for information or interpretation of preliminary drawings or specifications shall be made by normal correspondences, not by RFI. Architect’s responses to such requests do not constitute Contract requirements for the Work.

B. Owner Documents: Requests for information or interpretation of Owner-prepared Contract Documents shall be made by normal correspondence, not by RFI. Owner is responsible for responding to such requests. Provide contemporaneous copies to Architect.

C. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

D. Submittal of an RFI constitutes representation that the Contractor requires additional information about the Contract Documents AFTER making careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, and prior project correspondence or documentation.

E. If upon evaluation of the RFI the Architect finds that the requested information is contained in the Contract Documents or by other documents and/or methods as outlined in paragraph above, the Owner has the option to obtain reimbursement from the Contractor for costs incurred by the Owner for the Architect's services and expenses made necessary in answering such requests.

F. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Discipline (Architecture, Structural, Mechanical, Electrical, etc.).
9. Specification Section number and title and related paragraphs, as appropriate.
10. Drawing number and detail references, as appropriate.
11. Field dimensions and conditions, as appropriate.
12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

G. RFI Submission: All RFIs must be submitted in electronic form using the Architect's InfoExchange internet site. Paper RFIs, e-mail, faxes, and other media are not acceptable and will be returned without action.
1. At the beginning of the Project, the Architect will set up accounts for Contractor's authorized personnel, including log-in information and passwords. Users will be able to change passwords after logging in for the first time.
2. Complete the form provided by the InfoExchange software in full. Forms with boxes that are blank will not be processed.
3. In the box marked "Question", insert the text of the request together with Contractor's suggested resolution and other pertinent information.
4. Sketches, diagrams, product data sheets, and other supplementary information may be attached to the form as PDF electronic files, but the actual text of the request must be entered into the form. Forms that have "See attached document" or language of similar import in the Question box will be not be processed.
5. Web Address: http://infox.gspnet.com/userweb/login/login.aspx.

H. Architect's Action: Architect will review each RFI, determine action required, and respond. Allowfive working/seven calendar days for Architect's response for each RFI. RFIs received by Architect after 2:00 p.m. local time will be considered as received the following day.
1. If the date of response requested is less than five working/seven calendar days, the Architect will endeavor to respond when requested, however a failure to respond before the requested date shall not be the sole basis for any delay claims of time or money.
2. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

3. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
4. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five working/seven calendar days of receipt of the RFI response.

I. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within five working/seven calendar days if Contractor disagrees with response.

J. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by RFI number. Submit copies of log at Owner-Architect-Contractor meetings monthly.
1. Project name.
2. RFI number including RFIs that were returned without action or withdrawn.
3. RFI description.
4. Date RFI was submitted.
5. Date Architect's response was received.

K. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Include identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Include identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, in writing seven working days before each meeting, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of record documents.
    m. Use of the premises and existing building.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Construction waste management and recycling.
    u. Parking availability.
    v. Office, work, and storage areas.
    w. Equipment deliveries and priorities.
    x. First aid.
    y. Security.
    z. Progress cleaning.
    aa. Infection Control Risk Assessment (IRCA).

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility requirements.
    k. Time schedules.
    l. Weather limitations.

m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days before the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
a. Preparation of record documents.
b. Procedures required before inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at monthly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, sub-contractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
        1) Review schedule for next period.
    b. Review present and future needs of each entity present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of proposal requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Submittals schedule.
   2. Administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections:
   1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
   2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
   3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   5. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals. The Architect may designate portions of Action Submittals as Informational Submittals at its discretion.

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action, informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.

B. Review Initiation Date: Date submittal is received in the Architect's office, or the next working day when received after 2 pm local time.

C. Review Completion Date: Date submittal leaves the Architect's office.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of individual drawing files (not Construction Documents) of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor one set of digital data drawing files if requested in writing by Contractor for use in preparing Shop Drawings.
    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD (.dwg); Architect's standard software application and CAD file conventions for the project.
    c. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect has authority to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. Submittals received after 2 pm local time shall be deemed to have been received on the following working

day. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow at least 10 working/14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow at least 10 working/14 calendar days for review of each resubmittal.
3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow at least 15 working/21 calendar days for initial review of each submittal.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and Engineer and to Architect's consultants, allow at least 10 working/14 calendar days for review of each submittal. Submittal will be returned to Architect, before being returned to Contractor.

D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name and address of Contractor.
   e. Name and address of subcontractor.
   f. Name and address of supplier.
   g. Name of manufacturer.
   h. Submittal number or other unique identifier, including revision identifier.
      1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 1000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 1000.01.A).
   i. Number and title of appropriate Specification Section.
   j. Drawing number and detail references, as appropriate.
   k. Location(s) where product is to be installed, as appropriate.
   l. Other necessary identification.

E. Options: Identify options requiring selection by the Architect.

F. Deviations: Identify deviations from the Contract Documents on submittals.

G. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Use AIA Document G810.
2. Transmittal Form: Provide locations on form for the following information:
   a. Project name.

b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Transmittal number, numbered consecutively.
k. Submittal and transmittal distribution record.
l. Remarks.
m. Signature of transmitter.

3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Approved" or "Approved as Noted".

I. Special Procedures for Florida Healthcare:
1. For Florida Healthcare Work: The Contractor shall understand that the submittal of the required documents does not constitute compliance with the Requirements of the Contract Documents; only approval by the Architect/Engineer and when applicable, by the Agency for Healthcare Administration (AHCA) and/or local building code authority constitutes compliance.
a. The Contractor shall also understand that he may not submit shop drawings or requests for approval directly to agencies; all such submittals must be submitted through the Architect.
2. For Florida Healthcare Work: The Contractor is responsible for furnishing equipment, materials and labor for the project which meet the requirements of the codes and authorities referenced as well as the Contract Documents.
3. Refer to Division 01 Section "Product Requirements" regarding product substitutions.
4. For Florida Healthcare Work: Shop drawings which define non-structural elements affect the safety of the facility and its continued functioning after a natural disaster may require review and approval by the state and/or local agencies.
a. In all cases, however, the Architect has to first approve, and then submit to the agencies for their approval of any such shop drawings.
5. For Florida Healthcare Work: Work requiring shop drawings, whether called for by the Contract Documents or requested by the Contractor, shall not be started until the submission has been approved by the Architect.
a. The Architect's approval will indicate whether the work is subject to additional approval by state or local agencies and whether such approval has been obtained.
b. All work shall be in accordance with and performed from the approved shop drawings.

c. The Contractor or his sub-contractor shall make certain that unapproved shop drawings are removed from the project site.

6. For Florida Healthcare Work: Shop drawings required by the Contract Documents or by state/local agencies for architectural, mechanical, electrical, medical equipment or plumbing equipment essential to the continued functioning of the life-line procedures of the facility shall be submitted for approval as follows:
   a. Shop drawings shall be approved by the Architect for compliance with functional, windload and debris impact requirements. If required, the Architect will then forward the shop drawings to state and local agencies. Equipment shall be designed and fabricated to comply with Chapter 59A-3, of the Florida Administrative Code (FAC). The anchorage requirements for such equipment, as required by this document, have been explicitly detailed on the approved Contract Documents or referenced in the approved Project Manual. If details or guidelines for equipment anchorage is not found in the Contract Documents, but required, the Contractor shall notify the Architect and request that appropriate details be provided.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating action taken by Architect.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Action Submittals: Submit electronically.
   2. Informational Submittals: Submit electronically.
   3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
   4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   5. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Electronic Submittals: Contractor shall submit electronic files for action and informational documents per the following requirements instead of paper copies. The Architect will mark comments and apply its review stamp electronically before returning the files to the Contractor. Contractor is responsible for printing or otherwise distributing reviewed copies of submittals.
   1. File Format: Portable document format PDF vector or scanned files; no other format is acceptable. Files must include legible stamps and notations from Contractor’s review.

2. Submittal Method: The Architect will provide access to Newforma document management software without cost to Contractor. Contractor shall use the standard transmittal forms provided by the Architect. Using e-mail or other proprietary software is not acceptable.

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before or concurrent with Samples.
   6. Submit Product Data electronically.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 18 by 24 but no larger than 34 by 44 inches.

E. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.

c. Sample source.
d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

F. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in the following format:
      a. PDF electronic file.

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.
   4. Submit subcontract list in the following format:
      a. PDF electronic file.

K. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents.. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents..

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents..

S. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

U. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

X. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Y. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

Z. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certification, signed and sealed by the responsible design professional licensed in the state in which the project is located, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Certify that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
   1. Approved: Where submittal is marked "Approved", the Work covered by the submittal may proceed provided it complies with the Contract Documents.
   2. Approved as Noted: Where submittal is marked "Approved As Noted", the Work covered by the submittal may proceed provided it complies with both Architect's notations and corrections on the submittal and the Contract Documents.
   3. Revise and Resubmit: Where the submittal is marked "Revise and Resubmit", do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to Architect's notations and corrections.
   4. Rejected: Where the submittal is marked "Rejected", do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:
   1. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. 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.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
   1. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.

7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
   1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
   1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
   2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
   3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in and maintains current licensure in the state of Florida, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:.
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
   3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes schedule of abbreviations and acronyms used in Contract Documents to identify regulatory requirements, Codes and Standards.

B. Related Sections Include the Following:
1. Divisions 02 through 49 Sections for references to specific codes and standards.

1.2 QUALITY ASSURANCE

A. For applicable Federal, State and Local Codes, comply with the requirements of the code, except when more rigid requirements are specified. If the Code conflicts with these Contract Documents or any referenced standards or regulatory requirements, notify the Architect immediately.

B. The date of the code is that as listed in this section. References to standards of society, institute, association, or governmental agency which is part of the Code in effect for this project shall comply with the edition date published in the referenced edition of the Code.

1.3 SCHEDULE OF CODES

A. The following is a partial list of the codes enforced by Florida Agency for Health Care Administration (AHCA) Office of Plans and Construction (OPC) which have been used in the design and development of this project. See the Plan Review Data on the Project Information Sheet in the Drawings for additional codes enforced by Federal, State and Local Authorities.
1. 2010 Florida Building Code (Includes Florida Accessibility Code and Florida Energy Efficiency Code.)
2. 2010 Florida Building Code Test Protocols for High Velocity Hurricane Zones .
3. 2010 Florida Fuel Gas Code.
4. 2010 Florida Mechanical Code.
5. 2010 Florida Plumbing Code.
6. 2010 Florida Fire Prevention Code which includes:
    a. NFPA 1, Uniform Fire Code.
    b. NFPA 101, Life Safety Code.
    c. SFM Uniform Fire Safety Rules https://www.flrules.org/gateway/organization.asp?id=359 or (850)413-3619.
    d. Chapter 633, Florida Statutes, Fire Prevention and Control http://leg.state.fl.us/statutes/ or (850)413-3619.
7. 2008 National Electric Code (N.E.C.), NFPA 70
8. ASME A17.1:
    a. The 2012 Florida Accessibility Code, Chapter 11 of 2010 FBC enforces the ASME A17.1- 2010.
9. NFPA 1 – Uniform Fire Code (2009 Florida Edition).
10. NFPA 10 – 2007, Standard for Portable Fire Extinguishers
11. NFPA 13 – 2007, Standard for the Installation of Sprinkler Systems
12. NFPA 14 – 2007, Standard for Installation of Standpipe and Hose Systems, except 2-7 shall be omitted.

13. NFPA 25 – 2008, Standard for Inspection, Testing and Maintenance of Water-Based Fire Protection Systems, except that quarterly flow tests shall be required for those systems supplied by a municipal water supply.
14. NFPA 31 – 2006, Standard for the Installation of Oil Burning Equipment
15. NFPA 33 – 2007, Standard for Spray Application Using Flammable and Combustible Materials
16. NFPA 37 – 2006, Installation and Use of Stationary Combustion Engines and Gas Turbines
17. NFPA 45 – 2004, Standard on Fire Protection for Laboratories Using Chemicals
18. NFPA 50 – 2001, Standard for Bulk Oxygen Systems at Consumer Sites
19. NFPA 51 – 2007, Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting and Allied Processes
20. NFPA 51B-2009, Standard for Fire Prevention During Welding, Cutting and Other Hot Work
21. NFPA 54 – 2007, National Fuel Gas Code
22. NFPA 69 – 2008, Standard for Explosion Prevention Systems
23. NFPA 72 – 2007, National Fire Alarm Code
24. NFPA 75 – 2009, Standard for the Protection of Electronic Computer/Data Processing Equipment
25. NFPA 80 – 2007, Standard for Fire Doors and Windows
26. NFPA 80A – 2007, Recommended Practice for Protection of Buildings from Exterior Fire Exposures
27. NFPA 82 – 2004, Standard on Incinerators, Waste and Linen Handling Systems and Equipment
28. NFPA 86 – 2007, Standard for Ovens and Furnaces
29. NFPA 88A – 2007, Standard for Parking Structures
30. NFPA 90A – 2009, Standard for the Installation of Air Conditioning and Ventilating Systems
31. NFPA 90B – 2009, Standard for the Installation of Warm Air Heating and Air Conditioning Systems
32. NFPA 91 – 2004, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids
33. NFPA 92A – 2009, Recommended Practice for Smoke Control Systems
34. NFPA 92B – 2009, Guide for Smoke Management Systems in Malls, Atria, and Large Areas
35. NFPA 96 – 2008, Standard for Ventilation Control and Fire Prevention of Commercial Cooking Operations. Subdivision 7-2.2 of NFPA 96 applies prospectively only. Existing installations are permitted to remain in place subject to the approval of the authority having jurisdiction.
36. NFPA 99 – 2005, Standard for Health Care Facilities
37. NFPA 101 – Life Safety Code (2009 Florida Edition).
38. NFPA 101A – 2010, Guide on Alternative Approaches to Life Safety
39. NFPA 101B – 2002, Standard on Means of Egress
40. NFPA 105 – 2007, Recommended Practice for the Installation of Smoke Control Door Assemblies
41. NFPA 110 – 2005, Standard for Emergency and Standby Power Systems
42. NFPA 111 – 2005, Standard on Stored Electrical Energy Emergency and Standby Power Systems
43. NFPA 211 – 2006, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

44. NFPA 221 – 2009, Standard for Fire Walls and Fire Barrier Walls
45. NFPA 232 – 2007, Standard for the Protection of Records
46. NFPA 241 – 2004, Standard for Safeguarding Construction, Alteration and Demolition Operations
47. NFPA 251 – 2006, Standard Methods of Fire Endurance of Building Construction and Materials
48. NFPA 252 – 2008, Standard Methods of Fire Test of Door Assemblies
49. NFPA 255 – 2006, Standard Method of Test of Surface Burning Characteristics of Building Materials
50. NFPA 256 – 2003, Standard Methods of Fire Tests of Roof Coverings
51. NFPA 259 – 2008, Standard Test Method for Potential Heat of Building Materials
52. NFPA 260 – 2009, Standard Method of Test and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture
53. NFPA 261 – 2009, Standard Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes
54. NFPA 265 – 2007, Standard Method of Test for Evaluating Room Fire Growth Contribution of Textile Wall Coverings.
55. NFPA 267 – 1998, Standard Method of Test for Fire Characteristics of Mattresses and Bedding Assemblies Exposed to Flaming Ignition Sources
56. NFPA 286 – 2006, Standard Method of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
57. NFPA 703 – 2009, Standard for Fire Retardant Impregnated Wood and Fire Retardant Coatings for Building Materials
58. NFPA 704 – 2007, Standard System for the Identification of the Hazards of Materials for Emergency Response
59. NFPA 780 – 2011, Installation of Lightning Protection Systems
60. NFPA 1221 – 2010, Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems
61. NFPA 1561 – 2008, Standard on Emergency Services Incident Management System
62. NFPA 1962 – 2008, Standard for the Care, Use and Service Testing of Fire Hose including Couplings and Nozzles
63. NFPA 1963 – 2003, Standards for Fire Hose Connections
64. NFPA 2001 – 2008, Standard on Clean Agent Fire Extinguishing Systems
65. Additional NFPA Standards (in the editions as indicated) as listed in the 2010 FBC Chapter 35 Reference Standards.
66. Additional NFPA Standards (in editions indicated); listed in 2009 Edition of NFPA 101, Life Safety Code.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies genera definitions for the Specifications and other Contract Documents, including the Drawings.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

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

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700

AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000

ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BICSI	BICSI, Inc.	(800) 242-7405

	www.bicsi.org	(813) 979-1991
BIFMA	BIFMA International (Business and International Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)	(281) 583-4087

	www.cti.org	
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek.com	(800) 967-5352
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc., www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208

GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation (Now BWF)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234

IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591

NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393

REFERENCES

NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. (Now ITS)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) www.landcarenetwork.org	(800) 395-2522 (703) 736-9666
RCSC	Research Council on Structural Connections	

	www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026

SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. (Now TCNA)	
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700

WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

FBC	Florida Building Code www.floridabuilding.org	(850) 487-1824
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the

following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	

PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program	

	www.dps.dla.mil	
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AHCA	Agency for Health Care Administration Office of Plans and Construction 2727 Mahan Drive, MS-24 Ft. Knox Building #1, Suite 145 Tallahassee, Florida 32308 www.fdhc.state.fl.us/MCHQ/Plans	(850) 487-0713

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:
1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
2. Division 01 Section "Infection Control Requirements" for additional negative air pressure and dust control requirements.
3. Division 31 Section "Dewatering" for disposal of ground water at Project site.
4. Division 32 Section "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
5. Division 32 Section "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.2 USE CHARGES

A. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

B. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Sewer, Water, and Electric Power Service: Use charges are specified in Division 01 Section "Multiple Contract Summary."

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Comply with Division 01 Section "Infection Control Requirements" and Owner's "Infection Control Risk Assessment." Include the following:
1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1, and 2012 Florida Accessibility Code.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails for Contractor laydown areas.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch (42-mm-) OD top and bottom rails. Provide galvanized-steel bases for supporting posts for phased exterior construction.

C. Provide 50% capacity scrim over all construction chain link fencing; full height.

D. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

E. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

F. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm) on each side of construction barrier entry doors.

G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

H. Paint: Comply with requirements in Division 09 painting Sections and Division 01 Section "Infection Control Requirements."

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures."

C. Air Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.
1. Comply with Division 01 Section "Infection Control Requirements and Owner's "infection Control Risk Assessment."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Provide facilities that comply with requirements of accessibility codes enforced and of authorities having jurisdiction.

D. Provide facilities that comply with fire protection requirements of codes and of authorities having jurisdiction.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
1. Provide additional telephone lines for the following:
a. Provide a dedicated telephone line for each facsimile machine in each field office.
2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

I. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Processor: Intel Pentium D or Intel CoreDuo, 3.0 GHz processing speed.
2. Memory: 4 gigabyte.
3. Disk Storage: 300 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 22-inch (560-mm) LCD monitor with 256-Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet.
7. Operating System: Microsoft Windows XP Professional or Microsoft Windows Vista Business.
8. Productivity Software:
a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.

b. Adobe Reader 7.0 or higher.
c. WinZip 7.0 or higher.

9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Provide construction for temporary offices located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary parking areas for construction personnel.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   3. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division 01 Section "Execution."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in Division 01 Section "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 31 Section "Site Clearing."

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise. See Division 01 Section "Infection Control Requirements."
   1. Construct dustproof partitions of not less than 1-hour fire rating, with 31/2 inch R11 batts to reduce noise. Partitions shall extend to bottom of ceiling or to bottom of deck, where there is no ceiling. Provide polyethylene barriers above ceilings, complying with NFPA 701. Paint occupied side of partitions.
      a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
   2. Insulate partitions to control noise transmission to occupied areas.
   3. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
   4. Protect air-handling equipment.
   5. Provide walk-off mats on each side of each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard, replace, or clean stored or installed material that begins to grow mold.
   7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use permanent HVAC system to control humidity.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
      b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion of each construction phase.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
1. Division 01 Section "Alternates" for products selected under an alternate.
2. Division 01 Section "Substitution Procedures" for requests for substitutions.
3. Division 01 Section "References" for applicable industry standards for products specified.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged, and unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
   6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   7. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with

requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered, unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered, unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Owner-furnished, Owner-installed products (OFOI).
   2. Owner-furnished, Contractor-installed products (OFCI).
   3. Coordination and storage of Owner-furnished products.

B. Related Sections:
   1. Division 22 Section "Domestic Water Piping" for water connections.
   2. Division 22 Section "Drainage and Vent Piping" for wastewater connections.
   3. Division 26 Section "Equipment Installation and Wiring Systems" for power connection.

1.2 SUBMITTALS

A. Schedule: Contractor shall prepare and submit a schedule of dates for receiving rough-in data and taking delivery of OFOI and OFCI products.

1.3 QUALITY ASSURANCE

A. Installation of equipment shall be done by experienced workmen thoroughly trained in the necessary crafts to complete the work of this section.

B. Installation of each piece of equipment shall be in accordance with applicable mechanical and electrical codes.

1.4 RESPONSIBILITIES

A. Owner:
   1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
   2. Owner will arrange and pay for delivery of Owner-Furnished items according to Contractor's Construction Schedule.
   3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
   4. If Owner-Furnished items are damaged, defective, or missing, Owner will arrange for replacement.
   5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.

6. Owner will furnish Contractor the earliest possible delivery date for Owner-Furnished projects. Using Owner-Furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-Furnished items in Contractor's Construction Schedule.

B. Contractor:
1. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Owner, with a copy to the Architect, noting discrepancies or anticipated problems in installation of the item.
2. Contractor is responsible for receiving, unloading, and handling Owner-Furnished items at project site.
3. Contractor is responsible for protecting Owner-Furnished items from damage during storage and handling, including damage from exposure to the elements.
4. If Owner-Furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
5. Contractor shall install and otherwise incorporate Owner-Furnished items into the Work.
6. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.

1.5 COORDINATION

A. Extent of Owner furnished equipment is indicated in Owner Furnished Equipment "Book."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rough-in and connection materials shall be as specified in Divisions 22 and 26 and as required by manufacturer's installation instructions.

PART 3 - EXECUTION

3.1 COORDINATION

A. General Contractor shall be responsible for coordinating equipment installation with blocking in walls, mechanical and electrical rough-in and any special conditions indicated on submittal data received in accordance with his schedule of dates as agreed upon with the Owner.

B. Contractor shall arrange secure storage for equipment (OF/OI and OF/CI) from the agreed upon delivery date until date of installation.

3.2 INSTALLATION

A. Installation shall be in accordance with manufacturer's requirements.

B. Set equipment square and level, securely anchored, with joints flush and tight, calked where required.

3.3 CLEANING, RESTORING FINISHES

A. After completion of installation, and completion of other major work in the area, remove protective coverings, if any, and clean equipment internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored.

3.4 TESTING, START-UP AND INSTRUCTIONS

A. Contractor shall inform Owner when startup procedures can begin, shall furnish power as necessary and have electrical and mechanical contractor available to assist as required.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.
   9. Correction of the Work.

B. Related Requirements:
   1. Division 01 Section "Summary" for limits on use of Project site.
   2. Division 01 Section "Submittal Procedures" for submitting surveys.
   3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
   4. Division 02 Section "Selective Structure Demolition" for demolition and removal of selected portions of the building.
   5. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   3. Products: List products to be used for patching and firms or entities that will perform patching work.

4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Certified Surveys: Submit two copies signed by land surveyor.

E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Electrical wiring systems.
    j. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Equipment supports.
    e. Piping, ductwork, vessels, and equipment.

f. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.

6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
   1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.
   4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

EXECUTION

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for:
   1. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
   1. Section 02 4119 "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
   2. Section 31 1000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 DISPOSAL OF WASTE

A. General: Remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Requirements:
   1. Division 01 Section "Photographic Documentation" for submitting final completion construction photographic documentation.
   2. Division 01 Section "Execution" for progress cleaning of Project site.
   3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   5. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
   6. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 working/14 calendar days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
      a. Submit as-built survey(s) of all pedestrian ramps, if not previously submitted.
   3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.
   5. Submit test/adjust/balance records.
   6. Submit sustainable design submittals required in Division 01 sustainable design requirements Section and in individual Division 02 through 33 Sections.
   7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 working/14 calendar days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Advise Owner of pending insurance changeover requirements.
   2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   3. Complete startup and testing of systems and equipment.
   4. Perform preventive maintenance on equipment used prior to Substantial Completion.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
   6. Advise Owner of changeover in heat and other utilities.
   7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
   8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   9. Complete final cleaning requirements, including touchup painting.
   10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 working/14 calendar days prior to date the work will be completed and ready

for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, 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.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
   2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 working/14 calendar days prior to date the work will be completed and ready for final inspection and tests. 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.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Contractor.
      e. Page number.
   4. Submit list of incomplete items in the following format:
      a. PDF electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 working/21 calendar days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) 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 Electronic 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.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

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.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. 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. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. 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 designated 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. Remove snow and ice to provide safe access to building.
   f. 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.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
   k. Remove labels that are not permanent.
   l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   m. Clean plumbing fixtures, hospital equipment, to a sanitary condition, free of stains, including stains resulting from water exposure.
   n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
      1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
   p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
   q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
   1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
   2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
      a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
   3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
   4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

B. Related Requirements:
   1. Division 01 Section "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
   2. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   3. Division 01 Section "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
   4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, 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. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.

5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. 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.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Equipment or system break-in procedures.
   3. Routine and normal operating instructions.
   4. Regulation and control procedures.
   5. Instructions on stopping.
   6. Normal shutdown instructions.
   7. Seasonal and weekend operating instructions.
   8. Required sequences for electric or electronic systems.
   9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance

service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.
   7. List of cleaning agents and methods of cleaning detrimental to equipment.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.7 THROUGH-PENETRATION FIRESTOP SYSTEMS MANUAL

A. Content: Detail and description of each through-penetration Firestop System installed.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Requirements:
   1. Division 01 Section "Execution" for final property survey.
   2. Division 01 Section "Closeout Procedures" for general closeout procedures.
   3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   4. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and one of file prints.
         2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit one paper-copy set(s) of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for additional miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
   1. A certificate and drawing, from surveyor licensed in state where project is located, verifying that installed handicap ramp slopes are not greater than slopes indicated on project documents, and that the widths and lengths of the ramps indicated are considered minimum per governing codes.
   2. Fire protection (sprinkler) shop drawings and calculations with Tennessee Department of Health approval stamp, if not previously submitted.

E. Reports: Submit written report indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Construction Change Directive.
      k. Changes made following Architect's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.
   3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
   4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training video recordings.

B. Related Requirements:
   1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Architect.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. Date of video recording.
   2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
   3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.

g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.

c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.

2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. The General Requirements, Division 01 are hereby made a part of this section as if fully repeated herein.

B. Provide all concrete work shown and specified including form work, reinforcing steel, placing and curing.

C. All concrete for the project shall conform to requirements of ACI 301, except as modified by the Contract Documents.

1.2 CODES AND STANDARDS

A. Concrete work shall conform to the following by American Concrete Institute (ACI) unless modified herein or on the drawings.
   1. ACI 301: Specifications for Structural Concrete for Buildings.
   2. ACI 302: Guide for Concrete Floor and Slab Construction.
   3. ACI 304: Guide for Measuring, Mixing, Transporting, and Placing Concrete.
   4. ACI 308: Standard Practice for Curing Concrete.
   5. ACI 309: Guide for Consolidation of Concrete.
   6. SP-66: ACI Detailing Manual
   7. ACI 318: Buildings Code Requirements for Structural Concrete.
   8. ACI 347: Guide to Formwork for Concrete
   9. ACI 117: Standard tolerances for Concrete Construction and Materials.
   10. CRSI: Manual of Standard Practice

1.3 QUALITY CONTROL

A. Concrete Testing Service: The Owner shall employ and pay an independent testing laboratory to perform concrete testing. Laboratory shall meet the requirements of ASTM C 1077 "Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and criteria for Laboratory Evaluation."

B. Repairs to slabs must be in accordance with concrete industry standards and meeting waterproofing admixture manufacturer’s published details.

1.4 SUBMITTALS

A. Shop Drawings: Submit for fabrication and placement of concrete reinforcement. Comply with SP-66 and CRSI "Manual of Standard Practice" showing bar schedules and arrangement of reinforcement.

B. Mix Design Tests Reports: Submit testing facility reports for each proposed mix at least 10 days prior to start or work.

C. Concrete Tests Reports: Submit laboratory test report for each concrete test specified herein. Test results shall be reported in writing to the Architect-Engineer and Contractor on the same day that the tests are made. Reports of compressive strength tests shall contain the project title and A.E. File number, date of concrete placement, name of Contractor, name of concrete supplier and truck number, name of concrete testing service, location of concrete batch in the structure, design compressive strength and type of break for both 7-day tests and 28-day tests.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete Materials:
1. Portland Cement: ASTM C 150, Type I/II
2. Water: Clean and potable complying with ASTM C94
3. Air-Entraining Admixture: ASTM C 260
4. Water Reducing Admixture: ASTM C 494, Type A
5. Retarding Admixture: ASTM C 494, Type B
6. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
7. High-Range, Water-Reducing Admixture: ASTM C 494,Type F
8. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G
9. Plastizing and Retarding Admixture: ASTM C 1017, Type II
10. Chloride Ions: Do not use calcium chloride in concrete unless otherwise authorized in writing by the Architect-Engineer. Do not use admixtures containing chloride ions in excess of amount found in municipal potable water.

B. Aggregates:
1. Regular Weight Concrete: ASTM C 33.
2. Lightweight Concrete: ASTM C 330.
3. Grout: ASTM C 404.

C. Concrete Reinforcing:
1. Reinforcing Bars: ASTM A 615, Grade 60, deformed
2. Plain-Steel Wire: ASTM A 82, as drawn
3. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
4. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.
5. Weld-able Reinforcing Bars: ASTM A 706, Grade 60, deformed.

D. Anchor Bolts: Conform to ASTM F1554 Grade 36 unless otherwise indicated on drawings. Nuts shall conform to ASTM A563, hex nuts.

E. Vapor Retarder: Multi-ply reinforced polyethylene sheet, ASTM E 1745-09, Class A, not less than 15 mils thick. Install with all accessories recommended by the manufacturer.
   1. Acceptable Products: Stego Industries, LLC.

F. Curing Materials:
   1. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
   2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. When dry.
   3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
   4. Water: Potable.
   5. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   6. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

G. Preformed Joint Material: ASTM D 1752 Type I, II or III or ASTM D 1751. Provide Sealtight by W. R. Meadows or approved equal.

H. Non-Shrink Non-metallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications. Grout shall have a minimum 28-day compressive strength of 5,000 psi.

I. Form Materials:
   1. Forms for Exposed Finish Concrete:
      a. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
      b. Use overlaid plywood complying with U.S. Product Standard PS-1 "B-B High Density Overlaid Concrete Form", Class I.
   2. Forms for unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
   3. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces to be cured with water or curing compound.

2.2 CONCRETE MIXES

A. Comply with ACI 301 requirements for concrete mixes.

B. All concrete shall have a 28 day compressive strength as shown on the drawings. All concrete mixes shall be proportioned by the field experience method or the laboratory trial method in accordance with ACI 318.
   1. The maximum water/cement ratio shall be 0.55.
   2. All concrete, unless otherwise indicated, shall be air-entrained with an air content of 5% with a tolerance of ±1-1/2%.
      a. Do not allow air content of floor slabs to receive troweled finishes to exceed 3%.
   3. Lightweight concrete shall have a dry weight of not less than 107 pcf and not more than 113 pcf as determined by ASTM C 567.
   4. Fly ash shall be used, and can be up to 25% of the total cementitious weight.

C. Slump: Grout for filling masonry cells and cavities shall have a slump of 9-1/2 inches ±1-1/2 inch. Concrete shall have a slump of 4-1/2 inches ±1-1/2 inch, except slab on grades shall have a maximum slump of 4 inches.

2.3 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.
   1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Vapor Retarder: Install, protect, and repair vapor-retarder sheets according to ASTM E 1643-

98(2005); place sheets in position with longest dimension parallel with direction of pour.
1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended joint tape.
2. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
3. Tape all penetrations to form a complete seal as required by the manufacturer.

B. Formwork: Construct so that concrete members and structures are of correct size, shape, alignment, elevation and position. Chamfer exposed edges and corners of formed concrete 3/4 inch unless otherwise indicated. Conform to ACI 347. Design of formwork is the responsibility of the Contractor.

C. Reinforcement: Locate and support with metal chairs, runners, bolsters spacers and hangers, in compliance with CRSI "Manual of Standard Practice." For support of reinforcing steel in slabs or beams exposed to view underneath, furnish plastic accessories or accessories having plastic-coated feet.

D. Install welded wire fabric in as long lengths as practicable, lapping at least one mesh, + 6 inches.

E. Joints: Provide construction, isolation and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure, at locations indicated or approved by the Architect/Engineer.

F. Concrete Placement: Conform to ACI 304. Place concrete in a continuous operation with planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.

G. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into all parts of forms. Conform to ACI 309.

H. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

I. Cold Weather Placing:
1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified. When air temperature has fallen to or is expected to fall below 40 degrees F., uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degrees F., and not more than 80 degrees F. at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

J. Hot Weather Placing: When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
   1. Wet forms thoroughly before placing concrete.
   2. Do not use retarding admixtures unless otherwise accepted in mix designs.

K. Shoring shall remain in place until concrete has obtained 2/3 of the design strength, as determined by laboratory tests.

3.2 FINISH FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ½ inch.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed finished as-cast concrete where indicated:
   1. Smooth-rubbed finish.
   2. Gout-cleaned finish.
   3. Cork-floated finish.

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

3.3 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1 for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.
   1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes.
   2. Tolerance: ½ inch in 10 feet when tested with a 10 foot straightedge.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or

inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, equipment slabs, non-traffic exterior slabs, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
2. Tolerance: 5/16 inch in 10 feet when tested with a 10 foot straightedge.

D. Troweled Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155 for a randomly trafficked floor surface:
   a. Specified overall values of flatness, F_F 25; and levelness, F_L 20; with minimum local values of flatness, F_F 17; and levelness, F_L 15.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristlebroom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

3.4 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods.

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water
    b. Continuous water-fog spray
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.5 CONCRETE TESTING

A. Compressive strength Tests: Conform to ASTM C31 and ASTM C39. One set of four cylinders for each 100 c.u. yds., or fraction thereof, of each strength concrete placed in any one day. Test one specimen at seven days; test two specimens at 28 days and hold one in reserve.

B. Slump Tests: Conform to ASTM C143. Perform one test for each load point of discharge and one for each set of compressive strength test specimens.

END OF SECTION 03 3000

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. Samples for Verification: For each type and color of the following:
1. Exposed CMUs.

D. Qualification Data: For testing agency.

E. Material Certificates: For each type and size of the following:
1. Masonry units.
   a. Include material test reports substantiating compliance with requirements.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

G. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

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.
   1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. 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.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

C. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as indicated on Structural drawings.
2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
6. Rated Concrete Masonry Units: Comply with rating and construction requirements indicated by U.L. Designs on the drawings.

2.3 MORTAR AND GROUT MATERIALS

A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Masonry Cement: Not allowed.

D. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
   1. Exterior Walls: Hot-dip galvanized, carbon steel.
   2. Wire Size for Side Rods: As indicated on Structural drawings.
   3. Wire Size for Cross Rods: As indicated on Structural drawings.
   4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
   5. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder.

2.5 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use only portland cement-lime mortar.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in 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: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type S, unless otherwise noted.
   3. For mortar parge coats, use Type S or Type N.
   4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet , 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet , 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. 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.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel 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, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs 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.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems", unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

A. General: 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.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at[**corners,**] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.8 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

E. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.9 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.10 REPAIRING, POINTING, AND 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, where indicated.

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: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces and according to manufacturer's written instructions.

3.11 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manufactured stone veneer and trim.
   2. Setting mortar and lath.
   3. Sheet metal termination trim.

B. Related Requirements:
   1. Section 07 2500 Weather Barriers: Building wrap behind manufactured stone veneer.
   2. Section 07 6200 Sheet Metal Flashing.

1.2 DEFINITIONS

A. Manufactured Stone: Manufactured lightweight cementitious units with integral color molded to simulate natural stone and that are installed adhesively with mortar.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
   1. Each type of manufactured stone and related trim.
   2. Mortar ingredients.

C. Samples for Selection: Available standard mortar colors.

D. Samples for Verification: Manufactured stone with grout mounted on panel showing range of unit sizes and colors for selected blend; minimum24 by 24 inches.

1.4 INFORMATIONAL SUBMITTALS

A. ICBO Evaluation Report for manufactured stone.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturer’s maintenance recommendations.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years experience in installation of manufactured stone veneers.

B. Regulatory Requirements: ICBO acceptance.

C. Mock-Ups: Comply with requirements of Section 01 4000.

1. Exterior Manufactured Stone: Provide sample corner minimum 4 ft high by 6 ft long, with 2-ft return. Install mock-up on gypsum sheathing and weather barrier over CFMF framing. Provide suitable temporary concrete base.
2. Demonstrate installation techniques, including field cutting and joint tooling.
3. Demonstrate mortar color and other appearance characteristics.
4. Include all required types of manufactured stone, including corner, coping, and other trim units.
5. Include control joint, vent, and base drip screed.
6. Acceptable mock-ups will be comparison standards for the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000.

B. Store cementitious materials off ground, under cover, and in dry location.

C. Store aggregates where grading and other required characteristics can be maintained.

D. Protect stored manufactured stone from staining, abrasion, and other damage.

1.8 SITE CONDITIONS

A. Environmental Requirements: Minimum 40 deg F for 24 hours before, during, and for 48 hours after installation.
   1. Cold Weather Requirements: Comply with IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

B. Protect products from rain and moisture before, during, and for 48 hours after installation.

C. Do not allow construction activity on opposite side of wall during installation, nor for 48 hours after completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufactured stone: Tejas.
   1. Pattern: Imperial stack stone.
   2. Color Blend: See Drawings.
   3. Subject to compliance with requirements and acceptance of appearance characteristics by Architect, equivalent products of Coronado Stone may be proposed as Substitutions.

B. Trim:
   1. Factory-molded corners.
   2. Standard trim pieces that match adjacent field pieces.

C. Mortar: ASTM C270 Type S or Type N, as recommended by stone manufacturer for Project applications. Supply factory-blended dry mix in standard colors selected by Architect. Scratch coat may be standard gray color. Contractor may use one of the following types.

1. 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.
2. Mortar Cement: ASTM C1329.
3. Masonry Cement: ASTM C91.

D. Aggregate for Mortar: ASTM C144.

E. Mixing Water: Potable, free of substances that cause discoloration or adversely affect setting or strength of mortar.

F. Bonding Agent: As recommended by manufactured stone manufacturer for direct bond application to concrete unit masonry.

2.2 ACCESSORIES

A. Lath: Expanded metal lath fabricated from structural-quality, zinc-coated (galvanized) steel sheet conforming to ASTM A653, G60 minimum coating designation.
1. Type: Diamond.
2. Configuration: Self furring.
3. Weight: 3.4 lb/sq yd.

B. Strip Lath Reinforcement: Metal lath fabricated as follows.
1. Cornerite: Bent for 90 degree corners, minimum 2 inch legs.
2. Stripite: Flat strips 4 inches wide.

C. Drip Screed: Zinc alloy strips with perforations to allow infiltrated water to weep to exterior.

D. Lath Screws: ASTM C954 steel drill screws with organic corrosion-resistant finish.

E. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration with perforated flanges and removable protective tape on plaster face of control joint.
1. Base Metal: ASTM B69 zinc alloy, minimum 0.0207 inch thick, or 0.010 inch stainless steel.

F. Trim for Terminations and Penetrations: Form to indicated shapes per fabrication requirements of Section 07 6200. Hem exposed edges minimum 3/8 inch. Provide minimum 2-inch leg for attachment.
1. Base Metal: ASTM B69 zinc alloy, minimum 0.0207 inch thick, or 0.010 inch stainless steel.

2.3 MIXTURES

A. Comply with mortar mix manufacturer recommendations.

B. Provide Thoro Acryl 60 or other acrylic additive in mortar. Do not use other additives without prior permission of Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all penetrations in substrate are in place and sealed watertight.

B. Verify that weather barrier is complete and securely fastened.

3.2 PREPARATION

A. Remove substances that would hinder proper or timely execution, or adversely affect performance of finished Work.

B. Remove substances that impair adhesive bond of mortar, including form release agents, oil, and dirt.

C. Install minimum 6 inch wide strips of waterproof underlayment on each side of expansion and control joints in gypsum sheathing.

3.3 INSTALLATION – GENERAL

A. Comply with requirements of Section 01 7000.

B. Application Methods:
   1. Exterior Gypsum Sheathing Substrates: Set in mortar on metal lath attached to wall framing. Verify that weather barrier is complete before applying lath.
   2. Concrete Unit Masonry Substrates: Set in mortar directly applied to concrete block or in mortar on metal lath attached to concrete block.

3.4 INSTALLATION – METAL TERMINATION TRIM

A. Provide termination trim at top and side perimeters of manufactured stone, transitions to other materials, and penetrations.

B. Set termination trim directly on substrate. Screw trim to framing or structural substrate; do not anchor termination trim to gypsum sheathing. Apply sealant to fastener heads.

C. Lap vertical trim components minimum 4 inches in direction of water flow. Lap horizontal trim components minimum 6 inches.

3.5 INSTALLATION – METAL LATH AND ACCESSORIES

A. Reference Standard: Comply with ASTM C1063.

B. Install drip screeds at the base of walls, at opening heads, and other indicated locations. Provide sheet metal trim angles at all other terminations and penetrations.

C. Apply metal lath taut, with long dimension perpendicular to supports. Stagger ends of sheets.

D. Attach self-furring lath and drip screeds through sheathing to stud framing with screws.
   1. Nail attachment is not permitted.

E. Lap lath minimum 1-1/2 inch at sides. Lap lath minimum 1 inch at ends. Lap lath over metal termination trim. Nest laps.

F. Reinforce inside corners with continuous cornerite except where lath returns 3 inches from corner to form reinforcement. Fasten cornerite at perimeter edges only.

G. Install 12-inch lengths of stripite diagonally at corners of openings.

H. Install continuous stripite centered over junctions of dissimilar backing materials.

I. Control Joint Locations: Install at locations indicated or, where not indicated, at locations per following criteria in locations approved by Architect.
   1. Where recommended by manufacturer of manufactured stone.
   2. Where expansion or control joints occur in substrates directly behind mortar bed.
   3. Where there is a change in the substrate or the support for the substrate.
   4. Exterior Locations: Maximum 16 ft distance in any direction between control joints, and maximum length-to-width ratio of 2.5:1.

3.6 INSTALLATION – MANUFACTURED STONE

A. Lay out work to minimize field cutting.

B. Cut and fit units so that cut surfaces are fully covered with mortar when installed.

C. Install units level, with plumb corners and vertical terminations.

D. Install units to achieve random blend of appearance characteristics.

E. Install all units with long dimension horizontal.

F. Where unit sides are straight, install units with uniform joint widths.

G. Install factory-fabricated corners with alternating short and long sides for interlocked appearance.

H. Dampen masonry and concrete substrates immediately before applying mortar.

I. Application over Lath: Apply mortar scratch coat 3/8- to 1/2- inch thick per manufacturer's recommendation.

J. Application to CMU:
   1. Apply bonding agent to masonry and concrete substrates immediately before applying mortar.
   2. Apply mortar scratch coat 3/8- to 1/2- inch thick.

K. Allow scratch coats to cure for 48 hours before installing stone unless otherwise recommended by stone manufacturer for Project conditions.

L. Mortar Bed Option: If recommended by manufactured stone manufacturer, stone may be set directly in plastic mortar bed applied to CMU or lath.
   1. Apply mortar 1/2- to 3/4-inch thick, covering maximum 10 sq ft at one time.

M. Press units firmly into position in plastic mortar bed. Twist units and apply pressure to ensure full mortar bond, and to cause mortar to extrude around edge of units.

N. Grout joints with mortar. Tool mortar to form smooth, dense joints of uniform thickness and appearance that will shed water.
   1. Profile: Shallow concave.

O. Where units are intended to simulate dry stack stone place units with minimum width joints and keep mortar well back from face of stone to minimize grout visibility.
   1. Where mortar is exposed at terminations, tool to concave profile.

P. Remove excess mortar; do not allow mortar to harden on face of units.

3.7 CLEANING

A. Clean manufactured stone and mortar joints per manufacturer recommendations.

B. Do not use muriatic acid or other acidic cleaners. Proprietary masonry cleaners may be used only if specifically recommended in writing by manufactured stone manufacturer.

C. Use nonmetallic tools for cleaning. Do not use wire brushes.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work includes all structural steel shown, scheduled or otherwise required to complete the work, and all necessary connectors and accessories.

B. References herein to structural components such as trusses, pipe, columns, and girders shall be disregarded when such items are not included in the work.

1.2 QUALITY ASSURANCE

A. The following codes and publications, of the latest edition, govern this work unless indicated or specified otherwise. References in these codes and publications to inspection shall be deleted. The Architect-Engineer's job administration is defined in the General Conditions of the Construction Contract.

1. Code of Standard Practice for Steel Buildings and Bridges: A publication of AISC.
2. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings: A publication of AISC.
3. AWS D1.1 "Structural Welding Code": A publication of American Welding Society.
4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts."
5. Surface Preparation Specifications of the Steel Structures Painting Council: References appear as the specification number preceded by the initials "SSPC."
6. American Society for Testing and Materials: ASTM.

B. Certification of Welders: Welding of all structural steel shall be limited to welding operators whose competency has been tested in accordance with the Structural Welding Code of American Welding Society.

C. Testing: The Contractor shall employ and pay an independent testing laboratory to insure that all fasteners and welds are installed in accordance with the specifications.

D. Marking: Shop mark each piece of steel, plainly in a protected location in accordance with reference numbers on the shop drawings.

E. Fabricator and Erector: The fabricator and the erector shall be a current AISC certified fabricator and current AISC certified erector.

1.3 SUBMITTALS

A. Shop Drawings: Furnish for approval. For structural steel connections not designed or not shown on the structural drawings, or items indicated to be designed by the fabricator, the fabricator shall have the shop drawings signed and sealed by the qualified professional

engineer responsible for their fabrication. Fabrication before approval of shop drawings will be at the Contractor's risk.

B. Substitutions: Make requests for substitutions of sections and modifications to details by obvious notations on shop drawings. Do not proceed with the substitution until the Architect-Engineer has granted specific approval. No spliced members will be accepted unless splices are clearly shown on the shop drawings and approved by the Architect-Engineer.

C. Mill Reports: Furnish two copies, specifying chemical and physical properties of steel to be used on this project.

PART 2 – PRODUCTS

2.1 GENERAL

A. Structural Steel:

1. Wide Flanges: ASTM A992 (Grade 50)
2. Channels, Angles, Plates, S, M, H and Other miscellaneous steel: ASTM A36.

B. Pipes and Columns:
1. Pipe Columns: In accordance with ASTM A 53, Type E or S, Grade B, or API Standard 5L, Grade B.
2. Cold Formed Steel Tubing: In accordance with ASTM A500, Grade B.

C. Fasteners:
1. High Strength Bolt Steel: ASTM A325.
2. Anchor Bolts: ASTM F1554, Grade 36 and Grade 55 (UNO on the drawings).

2.2 STEEL DECK – COMPOSITE

A. General: Floor and roof deck shall be composite steel floor deck panels furnished in accordance with the standard conventions developed by the Steel Deck Institute, unless modified herein.

B. Specific Requirements: Shall meet the following minimum requirements:
1. As shown on the drawings.
2. Minimum yield strength 40,000 psi.

C. Finishes: Floor deck shall be zinc coated conforming to ASTM A 653, Class G60.

2.3 **STEEL DECK – ROOF** (Non Composite Areas)

A. General: Steel deck panels shall be furnished in accordance with the standard conventions developed by the Steel Deck Institute, unless modified herein.

B. Specific Requirements: Shall meet the following minimum requirements:
   1. As shown on the drawings.
   2. Minimum yield strength 33,000 psi.

C. Finishes: Floor deck shall be zinc coated conforming to ASTM A 653, Class G60.

D. Vent the flutes if required by the light weight insulating concrete manufacturer.

2.4 PRIMER

A. Pittsburgh's Multiprime, Tnemec's No. 99 Red, Glidden's Glid-Guard 4570 or Sherwin-Williams' Kem Kromik.

2.5 GROUT

A. Non-Shrink Non-metallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications. Grout shall have a minimum 28-day compressive strength of 5,000 psi.

2.6 GALVANIZING

A. Conform to ASTM Standards A 123, A 386, and A 153, as applicable. Galvanizing repair paint conforming to ASTM A 780.

PART 3 – EXECUTION

3.1 STRUCTURAL STEEL, FABRICATION

A. General: Comply with the applicable portions of the publications referenced in PART 1.

B. Eccentric Connections: One-sided or other eccentric connections are not permitted unless specifically shown. No combination of fasteners permitted in the same face of any connection.

C. Shop Connections: Furnish the type connections shown or noted; where not shown or noted, use either high strength bolting or welding. Where welding is used, apply heat symmetrically.

D. Nuts: Where machine bolts are shown, provide approved, self-locking type nuts, or upset the threads to prevent back-off.

3.2 STRUCTURAL STEEL, ERECTION

A. General: Comply with the applicable portions of the referenced publications.

B. Beams, Girders, Purlins, Columns, Trusses: Use steel wedges for leveling on masonry and concrete; remove the wedges after grouting and grout the resulting holes. Anchor to steel supports as shown.

C. Field Connections: Furnish the type connections shown or noted. Where not shown or noted, use either high strength bolting or welding. Where welding is used, symmetrical application of welding heat shall be used at all connection and symmetrical application with reference to the overall dimensions of the building to minimize distortion or misalignment.

D. Bearing Plates: Set in grout to elevations required or as shown on drawings.

E. Temporary Bracing: Furnish as necessary until permanent bracing is installed.

3.3 STRUCTURAL STEEL, COATINGS

A. Shop Cleaning and Priming:
1. Surfaces to be encased in concrete: Shop clean in accordance with SSPC Specification No. 3 and ship to the job site bare.
2. All other surfaces: Clean in accordance with SSPC Specification No. 3. Prime surfaces and work the paint well into all angles and crevices. Apply uniformly and free from surface irregularities and bare spots.

B. Job Site Treatment (After Erection):
1. Surfaces encased in concrete: Clean in accordance with SSPC Specification No. 3 no sooner than 48 hours before forming.
2. Field Touchup: Touchup all prime coated surfaces with same material as the prime coat. Field paint all unprimed bolts and accessories. Clean all welds and adjacent surfaces and touchup with one coat of primer. Clean and touchup all rusted areas with one coat of primer. Clean and touchup all rusted areas resulting from long exposure during storage or long exposure after erection. The prime coat over which succeeding coats are applied shall be sound and well bonded.

C. Final Painting: See Division 9 specifications.

D. Galvanizing:
1. General: Conform to ASTM Standards A 123, A 386, and A 153 as applicable wherever surfaces are indicated or specified to be galvanized. Galvanize after fabrication unless otherwise indicated or specified.
2. Repair: Repair all galvanized coatings that become damaged in handling, transporting, welding, or bolting. Make the repairs by application of a galvanizing repair paint conforming to ASTM A 780. Clean all areas that are to be repaired; remove slag from welds. Apply repair paint to cold surfaces.

3.4 OPEN WEB JOISTS AND JOIST GIRDERS

A. General: The steel joists shall be designed, fabricated and erected in accordance with the stipulations adopted by The American Institute of Steel Construction and The Steel Joist Institute. The following series joist types are covered by these stipulations: K. LH and DLH.

B. Manufacture: Steel joists shall be manufactured in a shop having membership in, and periodic inspection by, The Steel Joist Institute (SJI). Submit design verification tests on chord and web members, joints and connections.

C. Bottom Chord Extension Members: Furnish standard extension members where indicated or required for support of finished ceiling.

D. Bridging: Shall comply with SJI specifications and as shown on the drawings.

E. End Anchorage: Provide end anchorage to secure joists to adjacent construction.

F. Headers: Provide header units to support tail joists at openings in floor and roof not framed with steel shapes.

G. Shop Paint: Conform to standard specifications except black asphalt is not permitted in areas where joists are exposed to view or to be field painted.

3.5 STEEL DECK

A. General: Steel floor and roof deck panels shall be fabricated and installed in accordance with the provisions of the standard conventions developed by The Steel Deck Institute unless modified herein.

B. Shop Drawings: Shop drawings prepared by the deck manufacturer shall be submitted for review prior to fabrication and shall include manufacturer's literature with type of deck plainly marked. Where shop drawings of the supporting members are required, the deck shop drawings shall be prepared from approved shop drawings of the supporting members.

C. Erection:
1. The erection of the steel deck panels shall be in accordance with the manufacturer's recommendations and printed erection specifications. The manufacturer's representative shall be present during erection.
2. The steel deck panels shall be placed on the supporting steel framework and adjusted to final position before being permanently fastened. Each panel shall be brought to proper bearing on the supporting members. If the supporting members are not in proper level, correction shall be made before erection of the deck panels proceeds. Deck shall span 3 or more supports except where framing does not permit.
3. All welding shall be executed in the best AWS practice and welders shall be certified by AWS standards.
4. All abrasions to finish, welds and finishes damaged by welding shall be cleaned and touched up with inorganic zinc paint.

5. Steel floor deck units shall be permanently fastened by welding stud connectors through deck to steel beams or by round fusion welds as required by the drawings. Additional welding, if required, shall be in accordance with manufacturer's recommendations.
6. Studs shall be welded through a single thickness of previously installed steel deck. Top flange of beam shall be free of dirt, oil and water. Deck shall bear directly on beam flange and studs and shall be placed as shown on drawings. All other studs will be end welded with automatically timed stud welding equipment in accordance with manufacturer's recommendations.

3.6 STRUCTURAL STEEL, INSPECTION

A. General: An independent testing laboratory will insure that all fasteners, welds, and welded studs are installed in accordance with the specifications.

B. Bolted and Welded Connections: A visual inspection shall be made of all welded and bolted connections. In addition, a minimum of 10% of all high strength bolts shall be checked for proper tension and a minimum of 10% of all full penetration welds shall be checked by ultrasonic testing. Additional bolts and welds may be tested at the option of the testing lab representative. Defective bolts or welds shall removed and replaced at no additional cost to the Owner. No ultrasonic testing of welds shall be started until the weld is allowed to cool to the touch or a minimum time of 24 hours has elapsed after completion of the welding.

C. Welded Studs on Composite Beams: Establish settings and procedures before starting stud welding. Tests of first five welded studs shall be made by striking with a hammer until bent 45 degrees. A visual inspection of each beam shall be made for all welded stud connections. All questionable studs shall be tested by striking with a hammer to a minimum bend of 15 degrees from the vertical, but a minimum of 5 percent of all studs shall be tested. Should a significant number of these studs fail, a larger percentage of the studs shall be tested as deemed appropriate by the testing company and structural engineer of record. Replace all studs that crack in either the weld or the shank. The testing lab representative may select additional studs to be tested. Tested studs that show no signs of failure are satisfactory and may be left in the bent position.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior wall framing.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.

   a. Dead Loads: Weights of materials and construction.
   b. Live Loads: See drawings for loads
   c. Wind & Seismic Loads: See drawings for loads

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Exterior Non-Load-Bearing Framing: Horizontal deflection of L/600 of the wall height.
   b. For non-load-bearing framing, provide slip tracks or other vertical slip-connections for a minimum deflection of L/240 of the member that the connection is attaching to, but, not less than ½" upward and downward movement.
   c. Headers: Horizontal and vertical deflection of L/600 of the header span.

1.3 SUBMITTALS

A. Product Data: For each type of product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

1. For non-load-bearing framing, indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification data.

E. Product test reports.

F. Research/evaluation reports.

1.4 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code--Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

E. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance and at a minimum, as noted on the drawings.
2. Coating: G60, A60, AZ50, or GF30.

2.2 EXTERIOR WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch unless noted otherwise on the drawings.
2. Flange Width: 1-5/8 inches unless noted otherwise on the drawings.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and same minimum base-metal thickness as steel studs unless noted otherwise on the drawings.

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

C. Anchor Bolts: ASTM F 1554, Grade 36 threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

D. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

F. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.4 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

C. Install framing members in one-piece lengths.

D. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.2 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to infill studs and anchor to primary building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

    a. Install solid blocking at 48-inch centers.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.3 FIELD QUALITY CONTROL

A. Testing: The constractor shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Owner and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 4000

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood furring.
4. Plywood backing panels.

B. Related Requirements:
1. Division 06 finish carpentry Sections for nonstructural carpentry items exposed to view and not specified in another Section.

1.2 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood.
2. Power-driven fasteners.
3. Powder-actuated fasteners.
4. Expansion anchors.
5. Metal framing anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheets suitably anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
   3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal (38-mm actual) thickness or less, no limit for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior concrete walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. Application: Treat items indicated on Drawings, and the following:
   1. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Furring.
   5. Grounds.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber and any of the following species:
   1. Mixed southern pine; SPIB.
   2. Spruce-pine-fir; NLGA.
   3. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
   4. Eastern softwoods; NeLMA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine, No. 3 grade; SPIB.
   2. Spruce-pine-fir (south) or spruce-pine-fir, Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density, polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with applicable requirements of Section 01 7300.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

E. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

I. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size (19-by-38-mm actual-size) furring vertically at 16 inches (406 mm) o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall sheathing.
   2. Soffit sheathing.
   3. Sheathing joint and penetration treatment.

B. Related Requirements:
   1. Section 07 2500: Water-resistive barrier sheets applied over exterior wall sheathing and treatment of joints in gypsum sheathing**.**

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
   1. Gypsum sheathing.
   2. Cementitious backer units.
   3. Joint treatment materials.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 SHEATHING PRODUCTS

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corporation; GlasRoc.
      b. G-P Gypsum Corporation; Dens-Glass Gold.
      c. National Gypsum Company; Gold Bond e(2)XP.
      d. United States Gypsum Co.; Securock.
   2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

B. Cementitious Backer Units: ASTM C 1325, Type A.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. C-Cure; C-Cure Board 990.
      b. Custom Building Products; Wonderboard.
      c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
      d. USG Corporation; DUROCK Cement Board.
   2. Thickness: 5/8 inch (15.9 mm).

2.2 FASTENERS

A. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
   1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
   1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

C. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

G. Comply with GA-253 and with manufacturer instructions.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.
   2. Install boards with 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.

3. Install boards with 1/4-inch (6.4-mm) gap where they abut concrete or similar materials that might retain moisture, to prevent wicking.

H. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

I. Horizontal Installation: Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
1. Space fasteners approximately 8 inches (200 mm) o/c and set back minimum 3/8 inch (9.5 mm) from edges and ends of boards.

J. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
1. Space fasteners approximately 8 inches (200 mm) o/c and set back minimum 3/8 inch (9.5 mm) from edges and ends of boards.

K. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.2 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Plank Board Paneling.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.

1.2 DEFINITIONS

A. Paneling includes wood furring, blocking and shims for installing paneling, unless concealed within other construction before paneling installation.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers Association.
   2. NHLA: National Hardwood Lumber Association.
   3. NLGA: National Lumber Grades Authority.
   4. SPIB: The Southern Pine Inspection Bureau.
   5. WCLIB: West Coast Lumber Inspection Bureau.
   6. WWPA: Western Wood Products Association.

C. MDF: Medium-density fiberboard.

D. MDO Plywood: Plywood with a medium-density overlay on the face.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of product indicated and for panel products and adhesives

C. Samples for Verification:
   1. Lumber not less than 4 inches (101.6 mm) wide by 12 inches (300 mm) long.

D. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.

1.4 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.

1.5 CLOSEOUT SUBMITTALS

A. Specified manufacturer warranties.

1.6 QUALITY ASSURANCE

A. Qualification Data: For Installer.

B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

C. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.9 WARRANTY

A. Special Warranty for Columns: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace columns that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Columns: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.
   1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
   2. For exposed lumber, mark grade stamp on end or back of each piece.

2.2 STANDING AND RUNNING TRIM

A. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA HWM 2, N-grade wood moldings made to patterns included in WMMPA HWM 1.
   1. Species: Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar.
   2. Maximum Moisture Content: 9 percent.
   3. Finger Jointing: Not allowed.
   4. Matching: Selected for compatible grain and color.
   5. Shoe-Mold Pattern: As indicated on drawings.

2.3 PANELING

A. Prefinished Board Paneling (**HDWD-1**):
   1. Grade: Custom
   2. Product: Subject to compliance with requirements, provide the following by Shaw Contract Group.
      a. Source: Rebecca Crosby, Corporate Accounts Manager / A&D Specialist; rebecca.crosby@shawinc.com; 904-517-3308 (mobile).
   3. Style and Color: As indicated on Finish Listing Drawing D0.1.
   4. Description: 5 inch handscraped walnut.
   5. Species: Walnut.
   6. Color Variation: High.
   7. Edge Profile: 4 sided micro bevel.
   8. Gloss/Sheen: Low.
   9. Construction: 5-ply engineered with all hardwood core.
   10. Finish: Shawn Commercial-grade aluminum oxide.
   11. Width: 5 inches (127 mm).
   12. Length: 8 to 42 inches (203 to 1066 mm).
   13. Total Thickness: 0.5 inches (12.70 mm).
   14. Wear Layer Thickness: 0.1 inches (2.54 mm)

2.4 MISCELLANEOUS MATERIALS

A. Aluminum “J” Molding as manufactured by Fry Reglet Corporation. Color and finish as selected by Architect from manufacturer’s full range of options.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.5 FABRICATION

A. Back out or kerf backs of the following members except those with ends exposed in finished work:
   1. Interior standing and running trim, except shoe and crown molds.
   2. Wood board paneling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for minimum 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Comply with applicable requirements of Section 01 7300.

B. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
   1. Do not use manufactured units with defective surfaces, sizes, or patterns.

C. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
   3. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.
   4. Anchor paneling to supporting substrate with manufacturer recommended adhesive. Do not use face fastening unless covered by trim or otherwise indicated.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
2. Install trim after gypsum board joint finishing operations are completed.
3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 PANELING INSTALLATION

A. Board Paneling: Install according to manufacturer's written instructions. Arrange in random-width pattern suggested by manufacturer, unless boards or planks are of uniform width.
   1. Stagger end joints in random pattern to uniformly distribute joints on each wall.
   2. Fasten paneling to gypsum wallboard with panel adhesive.

3.6 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during remainder of the construction period.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Solid mineral profile paneling and seam finishing materials to create a monolithic sculptured wall surface.

B. Products Supplied But Not Installed/Used Under This Section: Installation kit.

C. Related Requirements:
1. 09 29 00–Gypsum Board: Substrate and seam finishing.
2. 09 91 23–Interior Painting: Sealing and painting of modular screen wall.

1.2 REFERENCES

A. Abbreviations and Acronyms:
1. ASTM American Society for Testing and Materials.
2. GA Gypsum Association.
3. CAN/ULC Underwriters Laboratories of Canada
4. CHPS Collaborative for High Performance Schools
5. LEED®: Leadership in Energy and Environmental Design.
6. USGBC United States Green Building Council.

B. Reference Standards:
1. ASTM D 256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
2. ASTM D 638 Standard Test Method for Tensile Properties of Plastics.
3. ASTM D 696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer.
4. ASTM D 790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D 2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
6. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
7. GA-214 Recommended Levels of Gypsum Board Finish.
8. CAN/ULC S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
9. California 01350 IAQ Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers
10. US Green Building Council: LEED® Green Building Rating System™.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meetings:

1. Convene meeting at project site within one week of scheduled start of installation with representatives of the following in attendance: Owner, Architect, General Contractor, Installer, Finisher, and Painter.
2. Review substrate conditions, requirements of related work, installation instructions, seam finishing, and painting instructions, storage and handling procedures, and protection measures.
3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.

1.4 ACTION SUBMITTALS

A. Product Data: Each product specified.

B. Project List: Minimum 5 previous completed ModularArts, Inc. installations or 5 installations of similar materials and complexity. Include contact name and e-mail address or telephone number for each project.

C. Shop Drawings: Show standard and project specific details including termination at adjacent surfaces.

D. Samples: Minimum 15 by 15 inch solid mineral panel of specified design(s).

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's installation instructions.

B. Qualification Statements: Proof of manufacturer, installer, and finisher qualifications.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Minimum five years experience in producing mineral profile paneling.
   2. Installer: Minimum three years experience in finish carpentry/architectural woodwork installation.
   3. Finisher: Minimum three years experience in executing Level 5 finish in accordance with GA-214.

B. Field Samples:
   1. Provide in a location selected by Architect showing representative sample of installed product including finished seam.
   2. Minimum Size: 8 by 8 feet.
   3. Approved field samples may remain as part of completed Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements:
   1. Store panels in fully enclosed space, protected against damage from moisture, direct sunlight, and surface contamination.

2. Store panels vertically, in shipping crates, until ready to be installed. Loosen crate lids to allow for venting. Do not stack or lean against walls.
3. Store panels in area of installation minimum 24 hours prior to installation.

B. Packaging Waste Management: 100 percent of materials used to package components of this section shall be recyclable.

1.8 FIELD CONDITIONS

A. Ambient Conditions:
1. HVAC: Operate HVAC system to maintain occupancy level temperature and relative humidity conditions (35 to 67 percent) in the area of installation from 24 hours prior to delivery of panels to the installation area through remainder of construction period.
2. Lighting: Permanent project lighting, including any special lighting used to highlight the profiled panels, must be operational prior to seam finishing.

1.9 WARRANTY

A. Manufacturer Warranty: Provide manufacturer's standard limited warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Modular Arts, Inc.

CORRESPONDENCE & BILLING ADDRESS:
944 NW Leary Way
Seattle, WA 98107

SHIPPING & RECEIVING ADDRESS:
4215 - 23rd Avenue West
Seattle, WA 98199

Tel: 206.788.4210
Fax: 206.788.4214
E-mail: info@modularArts.com
Website: www.modularArts.com

B. Substitution Limitations: None permitted.

2.2 COMPONENTS

A. Profile Panel: Smooth surface solid mineral composite panel containing no retardants, accelerators, release agents, or plastics.
1. Size: 32 by 32 by 1 inch maximum profile relief.
2. Physical Properties:
   a. Tensile Strength: ASTM D 638 — 960 psi.
   b. Modulus of Elasticity: ASTM D 638 — 1970 ksi.
   c. Flexural Strength: ASTM D 790 — 550 psi.
   d. Flexural Modulus: ASTM D 790 — 360 ksi.
   e. Izod Impact Strength: ASTM D 256 — 9.4 ft-lb/in^2.

f.	Hardness: ASTM D 2583	60 Barcol.
g.	Thermal Expansion: ASTM D 696	$3.8x10^{-7}$in/in °F.
h.	Compressive Strength: ASTM D 696	2.3 ksi.
i.	Flame Spread Index: ASTM E 84	0
j.	Smoke Development Index: ASTM E 84	0
k.	Rounded Average Flame Spread Rating (FSR): CAN/ULC	0
l.	Rounded Average Smoke Development Classification (SDC): CAN/ULC S102	10
m.	California 01350 IAQ Standard (CHPS)	Meets Standard
n.	Weight (for all designs excluding YUMA)	2.5 psf
o.	Weight (for YUMA design only)	3.8 psf

3. Design: as noted on Interior Design General Notes and Finish Listing drawing D0.1.
   Note: Modular Arts designs are protected by registered copyrights and may not be duplicated. Attempts to copy or closely mimic Modular Arts original designs will be considered a violation of intellectual property rights and will be duly pursued.

B. Installation Kit: Item quantities in parenthesis denote quantities for (Small Kit—up to 50 panels/Large Kit—up to 100 panels).
   1. Dry Mix Joint Compound: One 18 lb bag SHEETROCK® brand EASY SAND™ 45, or BEADEX® brand SILVER SET™ 40.
   2. Acrylic Fortifier: (One/Two) quart THORO® ACRYL 60®.
   3. Construction Adhesive: (12/24) 10.2 oz tubes PL® Polyurethane Premium Construction Adhesive.
   4. Primer Sealer: (3/6) gal VALSPAR® LATEX MULTI-PURPOSE PRIMER.
   5. Countersink Drill Bit with Depth Stop-Collar: (0ne/Two) No. 7.
   6. Flexible Spreader: (One/Two) MUDTOOLS SMT-Y2
   7. Sandpaper: (15/30) sheets No-Load 220G, (10/20) sheets No-Load 150G.
   8. Plastic Container: One 100 oz.
   9. Measuring Cup: One 8 oz.

2.3 ACCESSORIES

B. Anchors: 30 lb self-drilling, drywall anchor.

C. Screws: Coarse thread, drywall type, length as required by panel design and in accordance with Manufacturer's Installation Instructions.

2.4 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:

1.	Dimensions, length and width:	± 1/16 inch.
2.	Thickness:	± 1/16 inch.
3.	Weight:	± 1/2 lb.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which profile paneling will be installed.
   1. Verify that substrate is a material listed as an acceptable substrate by the profile paneling manufacturer.

B. Verify that permanent project lighting is in place and operational prior to start of seam finishing.

C. Coordinate with responsible entity to correct unsatisfactory conditions.

D. Commencement of work by installer is acceptance of substrate conditions.

3.2 INSTALLATION

A. Install profile paneling in accordance with Manufacturer's Installation Instructions except that seam finishing shall be performed under Section 09 29 00–Gypsum Board, and sealing and painting shall be performed under Section 09 91 23–Interior Painting.

3.3 CLEANING

A. Waste Management: Refer to Section 01 7419 Construction Waste Management and Disposal.

3.4 PROTECTION

A. Protect finished work from damage during remainder of construction period.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Laminate-faced architectural cabinets.
2. Laminate-faced work stations.
3. Wood furring, blocking, shims, and hanging strips for installing laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:
1. Section 09 2216 “Non-Structural Metal Framing” for concealed backing plates and other framing for support and anchorage of architectural cabinets.
2. Countertops are specified in Division 12.

C. As used in this Section and on Drawings, the terms “plastic laminate” and “high pressure decorative laminate” are synonymous.

1.2 PREINSTALLATION MEETINGS

A. Keying Conference: Meet with Owner to determine keying requirements for cabinet locks.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
1. High-pressure decorative laminate.
2. Cabinet hardware and accessories.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural laminate cabinets.
3. Show grain directions of patterned and metal laminates.
4. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Verification:
1. High-pressure decorative laminates, 12 by 12 inches (300 by 300 mm), for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Wood-grain laminates, 12 by 24 inches (300 by 600 mm), for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
3. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Fabricator Certification: Written certification by Fabricator and Installer that stile and rail wood paneling fabrication and installation conforms to requirements of cited reference standard publications.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products or Certified participant in AWI's Quality Certification Program.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets 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.

B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and co-ordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, backing plates, blocking, furring, reinforcements, and other related Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural laminate cabinets indicated for construction, finishes, installation, and other requirements.

B. Grade: Custom.

C. Core Material: Medium-density fiberboard [MDF].

D. Type of Construction: Face frame.

E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

G. Laminate Cladding for Exposed Surfaces:
1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.
4. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
5. Pattern Direction: As indicated.

H. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Concealed Backs of Panels with Exposed Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
1. Join subfronts, backs, and sides with glued dovetail joints.

K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated by laminate manufacturer's designations on Drawings.

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: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2,, made with binder containing no urea formaldehyde.
   2. Softwood Plywood: DOC PS 1, medium-density overlay.
   3. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
   4. Thermoset Decorative Panels: Medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Stainless Steel: BHMA 630.

B. Concealed Hardware Finish: Manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

D. Back-Mounted Pulls: BHMA A156.9, B02011.

E. Wire Pulls: Back mounted, solid metal, 5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.
   1. Amerock: Pull Riva BP55367G10

F. Catches: Magnetic catches, BHMA A156.9, B03141.

G. Shelf Rests: BHMA A156.9, B04013; plastic, two-pin type with shelf hold-down clip.
   1. Color: clear.

H. Wire Management: Snake Tray CM 501 Series wall snake.
   1. CM 501-3-8.

I. Drawer Slides: BHMA A156.9.
   1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   2. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.

3. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.

J. File Drawer Rails:
1. Grass America, Inc. System 6110 Pendaflex with lip for drop-in file folders.
2. Keller Products snap-on rail for attachment to top of file drawer sides.

K. Door Locks: BHMA A156.11, E07121.

L. Drawer Locks: BHMA A156.11, E07041.

M. Door and Drawer Silencers: BHMA A156.16, L03011.

2.4 ACCESSORY MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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. Adhesive for Bonding Laminates: Unpigmented contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details 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. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
   1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Decorative wall panels.
   2. Plastic panel partitions.
   3. Plastic panel room dividers.

B. Related Requirements:
   1. Section 09 2216: Steel stud framing for interior partitions.

1.2 COORDINATION

A. Concealed Supports: Coordinate locations of framing and supplementary supports to provide structural support for anchorage locations for post supports for decorative plastic panels.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
   1. Each required type of decorative plastic panel.
   2. Installation hardware.

C. Shop Drawings: Each installation area of decorative plastic panels.
   1. Use same unit designations used in Contract Documents.
   2. Show panel sizes and seam and joint locations.
   3. Show direction of decorative patterns.
   4. Show relationship with construction specified in other sections, including requirements for concealed supports.
   5. Show hardware supports and anchorages.

D. Samples for Verification:
   1. Decorative Plastic Panels: Each required color and pattern; minimum 4 by 4 inches in size.
   2. Partition and Room Divider Framing: Minimum 8-inch lengths.
   3. Post Supports: Each type.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Include manufacturer’s recommendations for cleaning.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000.

B. Do not deliver products to site until building is enclosed and HVAC systems are operating at levels intended for Owner occupancy.

C. Store products inside building and protected from damage.

D. Lay stored panels flat on continuous surface for full support.

E. Handle products to prevent damage to exposed surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

A. DP-2 Plastic Panels:
1. Manufacturer: 3form, Inc., Salt Lake City, Utah; 801-649-2500; www.3-form.com .
2. Product: Varia.
3. Color, Pattern: Timber Latitude Mocha
4. Front Face Finish: Sandstone
5. Back Face Finish: Sandstone
6. Thickness: As noted on Drawings.
7. Flame Spread: Class A; not more than 25 when tested per ASTM E84.
8. Impact Strength: Minimum 20 ft-pounds when tested per ASTM D3763.
9. Recycled Content: Minimum 40% post-industrial recycled content certified by a recognized third-party certification group, such as Scientific Certification Systems (SCS).

B. Panel Alignment Hardware: Stainless steel units specifically designed for capturing edges of adjacent plastic panels to maintain them in plane without vertical mullions; units have concealed fasteners and gaskets to prevent contact between metal components and plastic panels.
1. Manufacturer: 3form, Inc., Salt Lake City, Utah; 801-649-2500; www.3-form.com .
1. Product: 3Form Top Support for Varia.
2. Design: top channel (3-15-1796); bottom channel (3-15-1794).
3. Finish: as selected by Architect from manufacturer’s standard finishes.

2.2 ACCESSORIES

A. Fasteners, Adhesives: As recommended by manufacturer of decorative plastic panels for Project applications.
1. Do not use adhesives that contain urea formaldehyde.

2.3 FABRICATION

A. Fabricate decorative plastic panels and hardware at factory or in shop for site assembly with only minor trimming for fitting of concealed edges.

B. Fabricate decorative plastic panels with and straight and parallel edges.

C. Fabricate panels so that decorative patterns will be plumb and level after installation and have uniform alignment with adjacent panels.

D. Edges:
1. Exposed edges shall be factory or shop fabricated. Polish to uniform matte appearance.
2. Ease edges slightly and remove burrs from cut edges.

E. Corners: Square.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrates that receive decorative plastic panels are plumb and in plane.

3.2 PREPARATION

A. Allow plastic panels to reach ambient air temperature before installation.

B. Substrate Preparation: Remove dirt and other substances that impair adhesive bond.

3.3 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Install supporting hardware with concealed fasteners anchored to structural supports to form stable, rigid assemblies.

C. Install panel supports so that decorative plastic panels will be plumb, accurately aligned, and in plane.

D. Inspect exposed edges and faces of decorative plastic panels. Do not install substandard or damaged panels.

E. Set panels with decorative patterns plumb, level, uniform direction, and aligned with adjacent panels.

F. Install panels with captured edges with uniform depth in framing channels.

G. Ensure that manufacturer's recommended resilient components isolate decorative plastic panels from contact with metal support components.

H. Adhesive Installation:
   1. Install panels rigidly and securely with adhesive.
   2. Install panels without exposed mechanical fasteners.
   3. Distribute adhesive evenly to hold panels flat against substrate and in plane with adjacent panels.
   4. Install panels with full-contact butt joints that are plumb and level.
   5. Remove excess adhesive from exposed surfaces and edges immediately.

I. Maintain factory-applied finish protections during remaining construction period until final cleaning.

J. Tolerances:
   1. Plumb, Level: Maximum 1/8 inch deviation in 8 feet.
   2. Edge Offset Between Abutting Panels: Flush, no measurable offset.

K. After cleaning, inspect installed work.
   1. Provide new replacements for components with cracks, chipped edges, crazing, warping, hazing, discoloration, or that have soiling or stains that cannot be satisfactorily cleaned.
   2. Polishing to remove minor abrasion damage is subject to Architect's acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Polyurethane waterproofing.
   2. Latex-rubber waterproofing.

B. Related Requirements:
   1. Section 09 3000: Fluid-applied waterproof membranes beneath ceramic tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site per requirements of Section 01 3100.
   1. Review waterproofing requirements including, but not limited to, the following:
      a. Surface preparation specified in other Sections.
      b. Minimum curing period.
      c. Forecasted weather conditions.
      d. Special details and sheet flashings.
      e. Repairs.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

C. Shop Drawings:
   1. Show locations and extent of waterproofing.
   2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

D. Samples: For each exposed product and for each color and texture specified, including the following products:
   1. Flashing sheet, 8 by 8 inches (200 by 200 mm).
   2. Membrane-reinforcing fabric, 8 by 8 inches (200 by 200 mm).
   3. Insulation, 8 by 8 inches (200 by 200 mm).
   4. Paver pedestal assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturer warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer and authorized by manufacturer to perform warranted installations .

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Deliver liquid materials to Project site in original containers with seals unbroken and intact manufacturer labels.

C. Store liquid materials in their original undamaged containers in protected location within temperature range required by waterproofing manufacturer.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
   1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
   2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.9 MANUFACTURER WARRANTIES

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

A. Single-Component, Modified Polyurethane Waterproofing: ASTM C 836/C 836M and coal-tar free.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Anti-Hydro International, Inc; A-H Seamless Membrane.
      b. BASF Construction Chemicals, LLC, Building Systems; Sonoshield HLM 5000.
      c. Carlisle Coatings & Waterproofing Inc; MiraSEAL.
      d. CETCO; LDC 60.
      e. Neogard; Neogard 7401.
      f. Polyguard Products, Inc; Polyguard PG-250.
      g. Tremco Incorporated; Tremproof 201/60.
      h. United Coatings; Elastall 1000.

B. Single-Component, Reinforced, Modified Polyurethane Waterproofing: ASTM C 836/C 836M and coal-tar free.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals, LLC, Building Systems; Sonoshield HLM 5000.
      b. Carlisle Coatings & Waterproofing Inc; MiraSEAL..
      c. Pacific Polymers International, Inc; Elasto-Mat 100 (concrete).
      d. Urethane Polymers International, Inc; Elast-O-Meric BG-7011.

2.3 TWO-COMPONENT POLYURETHANE WATERPROOFING

A. Two-Component, Unmodified Polyurethane Waterproofing: ASTM C 836/C 836M.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing Inc; CCW 703 Liquiseal.
      b. Gaco Western LLC; GacoFlex LM-60.
      c. Pacific Polymers International, Inc; Elasto-Deck B.T. Two-Component.
      d. Tremco Incorporated; Vulkem 102.
      e. Urethane Polymers International, Inc; UIM-6430.

2.4 LATEX-RUBBER WATERPROOFING

A. Two-Component, Unreinforced, Latex-Rubber Waterproofing: ASTM C 836/C 836M; coal-tar free.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Grace Construction Products; W.R. Grace & Co. -- Conn; Procor.
   2. Hydrostatic-Head Resistance: 65 feet (20 m) minimum; ASTM D 5385.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated acrylic latex, polyurethane, or epoxy.

C. Sheet Flashing: Minimum 50-mil (1.3-mm) thick, nonstaining, uncured sheet neoprene.
   1. Adhesive: Manufacturer's recommended contact adhesive.

D. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

E. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; ASTM C 920, Type M, Class 25 or greater; Grade NS for sloping and vertical applications and as recommended by manufacturer for substrate and joint conditions.
   1. Backer Rod: Closed-cell polyethylene foam.

2.6 PROTECTION COURSE

A. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Henry Company; Asphalt Protection Board.
      b. Soprema, Inc; Sopraboard.
      c. W. R. Meadows, Inc; Protection Course.
   2. Thickness: 1/8 inch (3 mm), nominal, for vertical applications.
   3. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer.

B. Protection Course: Extruded-polystyrene board insulation with continuous surface skins on both faces intact, unfaced; ASTM C 578, Type X, 1/2 inch (13 mm) thick.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Owens Corning Insulating Systems LLC; Foamular Half-Inch.

C. Protection Course: Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 1471.

B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 1471. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
   1. Comply with ASTM C 1193 for joint-sealant installation.
   2. Apply bond breaker on sealant surface, beneath preparation strip.
   3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches (150 mm) wide along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.

B. Install sheet flashing and bond to deck and wall substrates where required according to waterproofing manufacturer's written instructions.
   1. Extend sheet flashings for 4 inches (100 mm) onto perpendicular surfaces and items penetrating substrate.

3.5 WATERPROOFING APPLICATION

A. Comply with applicable requirements of Section 01 7300.

B. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C 1471.

C. Start installing waterproofing in presence of manufacturer's technical representative.

D. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.

E. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
   1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of 60 mils (1.5 mm).
   2. Apply waterproofing to prepared wall terminations and vertical surfaces.

3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).

F. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

G. Install protection course with butted joints over waterproofing before starting subsequent construction operations.
1. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.
2. Board insulation may be used in place of a separate protection course for vertical applications when approved in writing by waterproofing manufacturer.

3.6 INSULATION INSTALLATION

A. Install one or more layers of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.

B. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish daily reports to Architect.

B. If test results or inspections show waterproofing does not comply with requirements, remove and replace or repair the waterproofing as recommended in writing by manufacturer, and make further repairs after retesting and inspecting until waterproofing installation passes.

C. Prepare test and inspection reports.

3.8 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Curtain wall insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.
4. Vapor retarders.

B. Related Sections:
1. Section 075216: SBS Modified Bituminous Roofing.

1.2 ACTION SUBMITTALS

A. Product Data:
1. Each required type of insulation.
2. Vapor retarders.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

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

PART 2 - PRODUCTS

2.1 CURTAIN WALL INSULATION

A. Curtain Wall Insulation: Unfaced mineral-wool board insulation conforming to ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Nominal density of 4 lb/cu. ft. (64 kg/cu. m), minimum R-4 per inch.
   a. IIG MinWool, LLC; CW4
   b. Roxul Inc.; CurtainRock 40
   c. Thermafiber FireSpan40
2. Color: Where visible through spandrel glazing, provide insulation with dark color fibers or glass mat facing.

B. Curtain Wall Insulation: Unfaced glass-fiber board insulation conforming to ASTM C 612; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84, passing ASTM E 136 for combustion characteristics.
   1. Nominal density of 2.25 lb/cu. ft. (36 kg/cu. m), minimum r-4.3 per inch.
      a. Owens Corning; CW 225

2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CertainTeed Corporation.
   2. Guardian Building Products, Inc.
   3. Johns Manville.
   4. Knauf Insulation.
   5. Owens Corning.

B. Recycled Content: Post consumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

C. Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

D. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

E. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
   1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
   2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.3 MINERAL-WOOL BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Fibrex Insulations Inc.
   2. Owens Corning.
   3. Roxul Inc.
   4. Thermafiber.

B. Recycled Content: Post consumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

C. Reinforced-Foil-Faced, Mineral-Wool Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.4 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Corporation.
      b. BaySystems NorthAmerica, LLC.
      c. Dow Chemical Company (The).
      d. ERSystems, Inc.
      e. Gaco Western Inc.
      f. Henry Company.
      g. NCFI; Division of Barnhardt Mfg. Co.
      h. SWD Urethane Company.
      i. Volatile Free, Inc.
   2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

2.5 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 10 mils (0.25 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

2.6 ACCESSORIES

A. Crack Sealer: Closed cell insulating foam in aerosol dispenser recommended by insulation manufacturer for filling gaps in board insulation.

B. Curtain Wall Insulation Clips: Z-shaped galvanized steel as recommended by insulation manufacturer.

2.7 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
b. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Gemco; 90-Degree Insulation Hangers.
2. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. AGM Industries, Inc.; SC150.
   b. Gemco; S-150.
2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
   a. Ceiling plenums.
   b. Attic spaces.
   c. Where exposed to human contact.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. AGM Industries, Inc.; TACTOO Adhesive.
   b. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

B. Remove projections capable of puncturing vapor retarder.

3.2 INSTALLATION, GENERAL

A. Comply with applicable requirements of Section 01 7300.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation in single layer unless otherwise shown or acceptable to Architect.

D. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated. If no specific method is indicated, comply with manufacturer recommendations.

B. Blanket Insulation:
1. Use insulation widths and lengths that fill cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Unfaced Blankets: Where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically to prevent sagging and other displacement.
5. Faced Blankets:
    a. Lap facing flanges and tape to metal studs, floor, and other adjacent surface to maintain continuity of vapor retarder.
    b. Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
    c. Install blankets in exterior walls with facing on interior side.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Spray Polyurethane Insulation: Apply according to manufacturer’s written instructions.

3.4 INSTALLATION OF CURTAIN-WALL INSULATION

A. Provide continuous coverage without discontinuities or voids.

B. Retain insulation in place by metal clips and straps or integral pockets within window frames spaced at intervals recommended by insulation manufacturer to hold insulation securely in

place without touching spandrel glass, but not more than 24 inches (600 mm) o/c. Maintain cavity indicated width between insulation and glass.

C. Brace insulation where it contacts safing insulation to prevent insulation from bowing under pressure from safing insulation.

3.5 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping at least two studs.
   1. Fasten vapor retarders at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.
   2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
   3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. 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 retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.6 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches (1219 mm) up either side of partitions.

3.7 CLEANING

A. Remove misapplications, spills, and displacements of loose insulation from ventilation spaces and other areas.

B. Remove misapplications and spills of adhesive from exposed surfaces.

3.8 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Protect foundation and perimeter slab insulation from damage and displacement during back-filling and concrete placement.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanically-fastened water barrier membranes.
   2. Self-adhesive air and water barrier membranes.
   3. Flexible flashing.

B. Related Requirements:
   1. Division 06 Section "Gypsum Sheathing" for sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of product.
   1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 MECHANICALLY FASTENED WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. DuPont (E. I. du Pont de Nemours and Company); Tyvek StuccoWrap.
      b. Pactiv, Inc.; GreenGuard RainDrop.
      c. Raven Industries Inc.; Fortress Pro Weather Protective Barrier.
   2. Water-Vapor Permeance: Not less than 50 g through 1 sq. m of surface in 24 hours per ASTM E 96/E 96M, Desiccant Method (Procedure A).
   3. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

C. Flexible Flashing, Primers: As recommended by manufacturer of water-resistive barrier for Project applications.

D. Penetration and Termination Sealant: As recommended by manufacturer of water-resistive barrier for Project applications.

E. Mechanical Fasteners: As recommended by manufacturer of water-resistive barrier for Project applications.

2.2 SELF-ADHESIVE WATER-RESISTIVE BARRIER

A. Water-Resistive Barrier: Self-adhesive air and water barrier membrane; vapor permeable; manufactured for commercial applications.
   1. Air leakage: Maximum 0.004 CFM/ft2 at 1.57 lbs/ft2 when tested per ASTM E2178
   2. Water Vapor Permeance: 29 perms when tested per ASTM E96.
   3. Resistance to Water Penetration: Pass ICC-ES AC 38
   4. Water Penetration Resistance around Nails: Pass when tested per AAMA 711-05 & ASTM D 1970 modified
   5. Surface Burning Characteristics: Flame spread rating of 0 and smoke development classification of 105 when tested per ASTM E84.
   6. Product: Henry Company; Blueskin VP 160.

B. Flexible Flashing, Primers: As recommended by manufacturer of water-resistive barrier for Project applications.

C. Penetration and Termination Sealant: As recommended by manufacturer of water-resistive barrier for Project applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all substrate penetrations are in place and securely fastened.

3.2 PREPARATION

A. Remove dust, dirt, oil, grease, and other substances that impair adhesive bond or performance.

B. Remove incompatible substances that affect membrane or flexible flashing.

C. Remove fins, ridges, mortar, and other projections.

D. Fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. Prime substrates.

G. Prepare joints and cracks per manufacturer recommendations.

H. Provide stainless steel sheet where needed to support membrane over gaps in substrates.

3.3 MECHANICALLY FASTENED WATER-RESISTIVE BARRIER

A. Apply membrane sheets plumb and level with end laps staggered between adjacent courses.

B. Cover sheathing with water-resistive barrier as follows:
   1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with minimum 4-inch (100-mm) overlap.
   3. Adhere barrier sheets to metal flashing; do not penetrate metal flashing with mechanical fasteners.

C. Fasten water-resistive barrier securely to framing with fasteners spaced as recommended by manufacturer for Project applications. Install fasteners in full contact with membrane without tears or enlarged holes.

3.4 SELF-ADHESIVE WATER-RESISTIVE BARRIER

A. Apply membrane sheets plumb and level with end laps staggered minimum 12 inches between adjacent strips.

B. Accurately align sheets and maintain uniform lap widths and end laps.

C. Apply sheets in shingled manner to shed water without interception by exposed sheet edges.

D. Overlap and seal seams to provide watertight and airtight installation. Install laps flat and smooth, without wrinkles, fish-mouths, or other defects.

E. Roll surfaces with positive pressure to ensure complete adhesion to substrates.

3.5 FLEXIBLE FLASHING

A. Extend flashings onto sills, jambs, and heads far enough in rough openings for watertight seal between flashing and perimeter frame of element in opening.

B. Apply flashing to penetrations and seal watertight.

C. Lap seams and junctures with other materials at least 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.

D. Lap flashing over water-resistive barrier at bottom and sides of openings.

E. Lap water-resistive barrier over flashing at heads of openings.

F. Lap inside and outside corners minimum 3 inches to provide two layers at changes in plane, unless using factory-formed corner pieces.

G. Install laps flat and smooth, without wrinkles, fish-mouths, or other defects.

H. Roll surfaces with positive pressure to ensure that flashing is completely adhered to substrates.

3.6 FIELD QUALITY CONTROL

A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air-barrier system has been provided.
   3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   4. Site conditions for application temperature and dryness of substrates have been maintained.
   5. Maximum exposure time of materials to UV deterioration has not been exceeded.
   6. Surfaces have been primed.
   7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
   8. Termination mastic has been applied on cut edges.
   9. Air barrier has been firmly adhered to substrate.
   10. Compatible materials have been used.
   11. Transitions at changes in direction and structural support at gaps have been provided.
   12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   13. All penetrations have been sealed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured standing-seam metal panel roofing system.

B. Related Sections:
1. Section 07 4213.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site per applicable requirements of Section 01 3100.
1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of purlins and rafters during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
1. Roofing System: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
2. Underlayment materials.

C. Shop Drawings:
1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

B. Manufacturer warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

C. Mockup: Build mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockups for typical roof area only, including accessories.
   a. Size: 12 feet (3.5 m) long by 6 feet (1.75 m).
2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.
3. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Package metal panels for protection during transportation and handling.

C. Handle metal panels in manner to prevent deformation and surface damage.

D. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

E. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTIES

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 10 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content: Post consumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

C. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: UL 90.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Merchant & Evans, “ZIP-RIB” or comparable product by one of the following:
      a. Advanced Architectural Products.
      b. AEP Span; a BlueScope Steel company.
      c. Architectural Building Components.
      d. Architectural Metal Systems; a Nucor company.
      e. ATAS International, Inc.
      f. Berridge Manufacturing Company.
      g. CENTRIA Architectural Systems.
      h. Dimensional Metals, Inc.
      i. Englert, Inc.

j. Fabral.
k. Firestone Metal Products, LLC.
l. Flexospan Steel Buildings, Inc.
m. Garland Company, Inc. (The)
n. IMETCO.
o. MBCI; a division of NCI Building Systems, L.P.
p. McElroy Metal, Inc.
q. Metal-Fab Manufacturing, LLC.
r. Metal Sales Manufacturing Corporation.
s. Morin; a Kingspan Group company.
t. Petersen Aluminum Corporation.
u. Ryerson, Inc.
v. Ultra Seam, Inc.
w. Union Corrugating Company

2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   a. Thickness: 0.040 inch (1.02 mm).
   b. Surface: Smooth, flat finish.
   c. Exterior Finish: Two-coat fluoropolymer.
   d. Color: As selected by Architect from manufacturer's full range.
3. Clips: Two-piece floating to accommodate thermal movement.
   a. Material: 0.025-inch- (0.64-mm-) thick, stainless-steel sheet.
4. Joint Type: As standard with manufacturer.
5. Panel Coverage: 12 inches (305 mm).
6. Panel Height: 2.5 inches (64 mm).

2.3 UNDERLAYMENT MATERIALS

A. Waterproof Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.; Grace Ice and Water Shield HT.
   c. Henry Company; Blueskin PE200 HT.
   d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
   e. Metal-Fab Manufacturing, LLC; MetShield.
   f. Owens Corning; WeatherLock Metal High Temperature Underlayment.

A. Synthetic Underlayment Sheets: Synthetic fabric sheets for mechanical attachment that are suitable for temperatures over 220 deg F (111 deg C), bitumen-free, have slip-resistant coating, and meet ICC-ES AC188 acceptance criteria for roof underlayment. Supply product with

detailing tape, fasteners, and other accessories recommended by underlayment manufacturer for Project applications.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Atlas Roofing Corporation; Summit.
   b. Engineered Coated Products; Nova-Seal II.
   c. Kirsch Building Products, LLC; Sharkskin Comp.
   d. SDP Advanced Polymer Products Inc; Palisade.
   e. Tamko Building Products; Tam-Shield Synthetic Underlayment.
   f. Comparable product recommended by metal panel roofing manufacturer.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners and bases. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o/c, fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
   2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
   3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal only by machine, including flashing, trim, and accessories. Hand forming of sheet metal is not allowed unless specifically approved by Architect.

E. Fabricate roofing panels in continuous, single pieces.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
   1. Size: As recommended by SMACNA "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

G. Hem exposed edges of metal on underside minimum 3/8 inch. Provide 15-degree break for drip at vertical faces, unless shown otherwise.

H. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate flashing for minimum 2-inch lap over protected construction. Return and hem edges.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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 same piece are unacceptable. 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. Aluminum Panels and Accessories:
1. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION – GENERAL

A. Comply with applicable requirements of Section 01 7300.

3.4 UNDERLAYMENT INSTALLATION

A. Cover voids in substrate with sheet metal to provide continuous support for membrane.

1. Minor voids in wood substrates may be filled flush with latex filler.

B. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
1. Apply over entire roof surface.

C. Synthetic Underlayment:
1. Apply over the entire roof surface.
2. Lay sheets in straight lines parallel to roof edge, free of wrinkles and fish mouths.
3. Lap sheets minimum than 2 inches (50 mm), or as recommended by manufacturer, in direction of water flow.
4. Fasten sheets as recommended by underlayment manufacturer for use below sheet metal roofing. Do not use staples.

D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 6200 "Sheet Metal Flashing and Trim."

3.5 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum 10 feet (3 m) with no joints within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced maximum 36 inches (914 mm) o/c using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o/c in between.
   1. Provide elbows at base of downspouts to direct water away from building.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in clean condition during construction.

B. Remove substances that would cause staining, corrosion, or premature weathering of exposed surfaces.

C. Provide new replacement components for components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

D. Minimize traffic on completed roof. Allow access only with clean, rubber-soled shoes.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal composite material MCM cladding systems.
   2. Aluminum composite material ACM cladding systems.

B. Related Requirements:
   1. Section 07 9200: Exposed sealants in MCM cladding.

1.2 COORDINATION

A. Coordinate locations of framing and other concealed supports for support and anchorage of MCM cladding.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
   1. Each type of MCM panel required. Include information on finishes.
   2. Installation system.

C. Shop Drawings: Shop drawings shall bear the seal of the Professional Engineer responsible for their preparation.
   1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
   2. Show weep locations.
   3. Show provisions for thermal and building movements.
   4. Show locations of panels that have fire-resistant cores.
   5. Show details for penetrations.
   6. Show grain direction of panel finishes.
   7. Accessories: Include details of the flashing, trim, and anchorage at scale of not less than 1-1/2 inches per 12 inches (1:10).

D. Samples for Verification: Each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Composite Material Panels: Minimum 24- by 36-inch panels mounted on ply-wood substrate and showing anchorage system.
      a. Include required sealants and gaskets.
      b. Include 4-way joint in sample.
      c. If acceptable to Architect, separate finish samples minimum 12 by 18 inches in size may be provided instead of apply finish to fabrication sample.
   2. Sheet Metal Trim: Minimum 24-inch lengths of representative profiles. Trim may be mounted on same board as MCM panel sample.

1.4 INFORMATIONAL SUBMITTALS

A. Structural Design: Submit copies of approved tests of MCM cladding system or engineering analysis to the building official evidencing compliance with requirements for wind loading. Provide contemporaneous copies of such documentation to the Architect with Action Submittals.

B. Fabricator/Installer qualification data. Include name and experience statement for Professional Engineer responsible for delegated design.

C. Product Test Reports: Provide copies of reports indicating that cladding system has been tested in accordance with and complies with the acceptance criteria of NFPA 285 in the maximum MCM panel thickness intended for use and with the specified continuous insulation.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

B. Manufacturer warranties.

1.6 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications:
1. Minimum 5 years experience in the engineering design and installation of MCM exterior cladding systems.
2. Employing a Professional Engineer registered in the state where Project is located to design exterior cladding system installation for specified performance criteria.
3. Having test data for performance attributes of required type of cladding system.

B. Mock-Ups: Build mock-ups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mock-up of typical metal composite material panel assembly 3 feet by 4 feet, including one corner, intersecting vertical and horizontal joints, terminations, supports, attachments, and accessories.
2. Water-Spray Test: Conduct water-spray test of mock-up of metal composite material panel assembly, testing for water penetration according to AAMA 501.2.
3. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal composite material panels, and other manufactured items without deformation or other damage. Package metal composite material panels for protection during transportation and handling.

B. Unload, store, and erect metal composite material panels in manner to prevent deformation, abrasion, and other surface damage.

C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite material panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide leakproof, secure, and noncorrosive installation.

1.10 MANUFACTURER WARRANTIES

A. Special Warranty for Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing, and dislodgement under stated design conditions.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer’s Warranty: On manufacturer’s standard form, in which manufacturer agrees to repair or replace metal wall panel assemblies that fail in materials and workmanship within two years from date of Substantial Completion.

C. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS FOR EXTERIOR CLADDING

A. Provide engineering design of cladding system, fabrication, and installation to meet specified performance requirements.
   1. Verification: Technical information in printed Product Data or copies of test reports evidencing compliance of design with performance requirements.

B. Structural Performance: Panels shall withstand design wind loads without delamination, permanent deformation, or loss of weather resisting properties.
   1. Design Wind Loads: As indicated on Structural Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, maximum 1/180 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference.
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference.
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

E. Building Movements: Accommodate anticipated building movements indicated on Structural Drawings without damage to system, including loosening of anchorages, and without loss of weather resisting properties.

F. Thermal Movements: Accommodate thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, loss of weather resisting properties, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

G. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL "Fire Resistance Directory" or from listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 CLADDING SYSTEM DESIGN REQUIREMENTS

A. Support and Anchorage System:
   1. Face-sealed joints.
   2. Gasketed joints.
   3. Splined joints.
   4. Open joints with drainage plane.
   5. Pressure-equalized rain screen.

B. Support and Anchorage: Multiple systems noted on Drawings.

C. Anchorage and joint configurations shown on Drawings are diagrammatic. Alternative methods of concealed anchorage for achieving the appearance depicted will be acceptable.

D. Provide anchorage system that permits removal of individual panels without disturbing adjacent panels.

E. Provide anchorage system that supports and captures entire length of all panel edges.

F. Provide weep system to direct infiltrated water and condensation to exterior. Locate weeps in unnoticeable locations acceptable to Architect.
   1. Weeps are not required for interior applications.

G. Provide cladding panels that have fire-resistant cores where indicated or where required by applicable codes. Indicate locations on Shop Drawings.

2.3 METAL COMPOSITE MATERIAL WALL PANELS

A. Metal Composite Material Wall Panels: Manufactured panels comprised of two metal facings bonded to an extruded thermoplastic core.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide 3A Composites USA, Inc. or comparable product by one of the following:
      a. Alcoa Inc.; Reynobond .
      b. CENTRIA Architectural Systems; FormaBond.
      c. Mitsubishi Plastics Composites America, Inc; Alpolic.

2.4 FABRICATION

A. Fabricate and finish metal composite material panels and other cladding system components at factory or shop. Fabricate components by manufacturer's recommended procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Cladding Panels: Fabricate smooth, flat panels that can be installed in plane without distortion and with uniform joint widths.
   1. Fabricate panels with straight edges, without displacement of facer sheets or protrusion of core.
   2. Fabricate panels so that no cut edges are visible after installation.
   3. Fabricate panels with bent edges of uniform radius and appearance.
   4. Fabricate panels with return edges on all sides using rout-and-return method.
   5. Seal corner joints watertight.
   6. Where needed to minimize oil-canning and deflection from wind loads, provide stiffening angles on concealed side. At Contractor’s option, panels may be fabricated from thicker stock.
   7. Fabricate panels with consistent grain direction as indicated on Drawings or directed by Architect. Show grain direction on Shop Drawings and mark concealed side of panels for correct installation orientation.

C. Curved Surfaces: Form curved surfaces to smooth, uniform radii without kinks or flat spots.

1. Curved Edges: Miter meeting edges of panel face and return edge to provide flush, full-contact joint, and reinforce with continuous angle. Seal concealed side of joint water-tight.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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 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. Aluminum Panels and Accessories:
1. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

C. Verify that air- and water-resistive barriers and flashings that will be concealed by metal composite material panels are installed and have been observed.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and cladding system manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

C. Fasteners:
   1. Aluminum Panels: Aluminum or stainless-steel fasteners.
   2. Copper Panels: Copper, stainless-steel or hardware-bronze fasteners.

D. Inspect panels before installation. Do not install defective or damaged components.

E. Install MCM panels plumb, level, and with accurately aligned, straight joints of uniform width. Install panels so that cores are not visible in finished Work.
   1. Sealant Joints: Prepare joints for application of sealant specified in Section 07 9200.
   2. Spline Joints: Provide splines of size that will be fully engaged and will remain in place under indicated design loads and building movements.
   3. Gasket Joints: Install gaskets with end seams and joint surfaces in full contact, with full coverage, and in maximum lengths with joints located per manufacturer recommendations.

F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action.

G. Provide shims as needed to install MCM panels in true planes and accurately aligned with other construction.

H. Anchor metal composite material panels and other components of the Work securely in place to structural supports, with provisions for thermal and structural movement.

I. Install flashing and trim as metal composite material panel work proceeds.

J. Verify that weeps in exterior cladding system are unblocked and effective before permanently installing components.

K. Penetrations:
   1. Verify that penetrating items are rigidly installed so they will not transmit force into cladding system panels.
   2. Verify that joint at drainage plane weather-resistive barrier has been sealed watertight.
   3. Install factory- or shop-fabricated trim on panels and seal watertight.

L. Support and Attachment, General: Install attachment assembly required to support metal composite material wall panels and to provide complete weathertight wall system to achieve performance and design requirements.

M. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

N. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage qualified independent testing agency to perform field tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.

D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured metal soffit panels.
   1. Section 07 4113.13 "Formed Metal Roof Panels" for lap-seam metal roof panels.
   2. Section 07 4213.13 "Formed Metal Wall Panels" for lap-seam metal wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
   3. Include details for penetrations.
   4. Include coordination details for connections and terminations at other construction.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

B. Manufacturer warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical roof eave, including fascia, and soffit as shown on Drawings; approximately four panels wide by full eave width, including attachments and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Handle metal panels in manner to prevent deformation and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 MANUFACTURER WARRANTIES

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/180 of span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. V-Groove-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with a V-groove joint between panels.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Petersen Aluminum Corporation or comparable product by one of the following:

a. ATAS International, Inc.
b. Berridge Manufacturing Company.
c. Dimensional Metals, Inc.
d. Englert, Inc.
e. Fabral.
f. Innovative Metals Company, Inc.
g. McElroy Metal, Inc.

2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   a. Thickness: 0.032 inch (0.81 mm).
   b. Surface: Smooth, flat finish.
   c. Exterior Finish: Two-coat fluoropolymer.
   d. Color: As selected by Architect from manufacturer's full range, see drawings.
3. Panel Coverage: 12 inches (305 mm).
4. Panel Height: 0.50 inch (13 mm).

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
   2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
   3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Fabricate soffit panels in continuous, single pieces.

F. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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 same piece are not acceptable. Variations in appearance of other components are accepta-

ble if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:
   1. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
   2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
      a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
   1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

C. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
4. Stainless-Steel Panels: Use stainless-steel fasteners.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

F. Watertight Installation:
1. Apply continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed

fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Remove substances that would cause staining, corrosion, or premature weathering of exposed surfaces.

D. Provide new replacement components for components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
2. Vapor retarder.
3. Roof insulation.
4. Walk pads.

B. Related Requirements:
1. Section 06 1053: for wood nailers, curbs, and blocking.
2. Section 07 6200: Metal roof flashings and counterflashings.
3. Section 07 7100: Roof specialties.
4. Section 22 1423: Roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: Roofing system components.
1. Roof membrane.
2. Roof insulation.

3. Cover boards.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes and calculation of average R-values.
   3. Crickets, saddles, and tapered edge strips, including slopes.
   4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

D. Samples for Verification:
   1. Cap sheet, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Certification: Submit manufacturer's signed statement that Project design and conditions have been reviewed and that the installation will be fully warrantable if correctly installed. This informational submittal may be in the form of a copy of manufacturer's authorization to Installer to proceed with installation.
   1. Submit letter on manufacturer's letterhead, signed by an officer of the company, stating that roofing system installer is approved to install specified roof system.

B. Submit manufacturer's current state or local Product Approval Notice indicating product's acceptance for use in accordance with FBC. Notice of Approval shall indicate product control number, expiration date of approval, and specific conditions governing the approval.

C. Preinstallation meeting records.

D. Manufacturer's Inspection Reports: Submit copies of inspection reports and punch lists prepared by representatives of membrane manufacturer within 2 working days of their receipt by Installer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Manufacturer warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: UL listed for membrane roofing system identical to that used for this Project.

A. Installer Qualifications: Approved, authorized, or licensed by membrane roofing system manufacturer to perform warranted installations and has minimum 5 years successful experience in application of specified roof system.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

C. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

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

E. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Manufacturer Warranty: Provide warranty without monetary limitation, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by qualified testing agency to resist field, perimeter, and corner uplift pressures specified on Structural Drawings.

A. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Energy Star Listing: Roofing system shall be listed on the DOE ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

2.2 ROOFING SHEET MATERIALS

A. Roofing System: Glass-fiber-reinforced SBS-modified bituminous membrane roofing.
1. GAF Materials Corporation; Ruberoid System.
2. Johns Manville International, Inc.; Dyna Base base ply with Dyna Glas finish ply.
3. Siplast, Inc., A member of the Ipocal Group; Paradiene System.
4. Soprema Roofing and Waterproofing Inc.; Elastophene base and finish plies.

B. Cap Sheet Color: White.

C. Base Sheet: SBS-modified asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.
1. Weight: 50 lb/100 sq. ft. (2.4 kg/sq. m), minimum.

D. Base Sheet: ASTM D 4601, Type I, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

E. Glass-Fiber Base-Ply Sheet: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt.

F. Smooth-Surfaced Roofing Cap Sheet: ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers); smooth surfaced; suitable for application method specified.

G. Granule-Surfaced Roofing Cap Sheet: ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers); granule surfaced; suitable for application method specified, and as follows:
1. Granule Color: White.

2.3 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers); smooth surfaced; suitable for application method specified.

B. Metal-Foil-Surfaced Flashing Sheet: ASTM D 6298, glass-fiber-reinforced SBS-modified asphalt sheet (reinforced with glass fibers); metal-foil surfaced; suitable for application method specified, and as follows:
1. Foil Surfacing: Aluminum.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Provide auxiliary materials recommended by roofing system manufacturer for Project applications.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Roofing Asphalt: ASTM D 312, Type III or IV as recommended by roofing system manufacturer for application.

C. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

D. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

F. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

A. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

B. Provide factory- or shop-formed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

A. General: Supply roof insulation accessories recommended by roofing system manufacturer for Project applications.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Modified asphaltic, asbestos-free, cold-applied adhesive.

D. Cant Strips: As recommended by roofing system manufacturer for Project applications.

E. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

A. Wood Nailer Strips: Comply with requirements in Section 061053 "Miscellaneous Rough Carpentry."

B. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. CertainTeed Corporation; GlasRoc Sheathing.
      b. Georgia Pacific Corporation; Dens Deck.
      c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
      d. Temple-Inland, Inc; GreenGlass Exterior Sheathing.
      e. USG Corporation; Securock Glass Mat Roof Board.

C. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.

2.7 WALKWAYS

A. Walkway Cap-Sheet Strips: ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers); granule surfaced; suitable for application method specified, and as follows:
   1. Granule Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION, GENERAL

A. Comply with applicable requirements of Section 01 7300.

B. Asphalt Heating: Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application. Circulate asphalt during heating. Do not raise asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating. Do not heat asphalt within 25 deg F (14 deg C) of flash point. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
   1. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

C. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSULATION INSTALLATION

A. Install one lapped base-sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.

B. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 degrees.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation with long joints of insulation in continuous straight lines, with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer minimum 6 inches (150 mm) in each direction.

F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m), and allow primer to dry.
   2. Set each layer of insulation in a solid mopping of hot roofing asphalt.

I. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

J. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
   2. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt.

K. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below minimum 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.
   1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
   2. Apply hot roofing asphalt to underside, and immediately bond cover board to substrate.

3.5 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

B. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
   1. Adhering Method: M (mopped).
   2. Number of Glass-Fiber Base-Ply Sheets: One.
   3. Number of SBS-Modified Asphalt Sheets: One.
   4. Surfacing Type: M (mineral-granule-surfaced cap sheet).

C. Start installation of roofing in presence of manufacturer's technical personnel.

D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
   1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
   2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.6 BASE-PLY SHEET INSTALLATION

A. Install glass-fiber base-ply sheets according to roofing system manufacturer's written instructions starting at low point of roofing system. Align glass-fiber base-ply sheets without stretching. Extend sheets over and terminate beyond cants.
   1. Shingle side laps of glass-fiber base-ply sheets uniformly to ensure that required number of glass-fiber base-ply sheets covers substrate at any point. Shingle in direction to shed water.

2. Embed each glass-fiber base-ply sheet in a continuous void-free mopping of hot roofing asphalt to form a uniform membrane without glass-fiber base-ply sheets touching.

3.7 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
   1. Adhere to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C).

B. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
   1. Repair tears and voids in laps and lapped seams not completely sealed.
   2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing sheets so side and end laps shed water.

3.8 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
   1. Prime substrates with asphalt primer if required by roofing system manufacturer.
   2. Backer-Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants in a solid mopping of hot roofing asphalt.
   3. Flashing-Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt or cold-applied adhesive, as recommended by roofing system manufacturer for Project applications.

B. Extend base flashing up walls and over parapet 4 inches (100 mm) onto field of roofing membrane unless noted otherwise.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

E. Roof Drains: Set 30-by-30-inch- (760-by-760-mm-) metal flashing in bed of asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing cap-sheet stripping, and extend minimum 6 inches (150 mm) beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
   1. Install stripping according to roofing system manufacturer's written instructions.

3.9 WALKWAY INSTALLATION

A. Walkway Cap Sheet Strips: Install walkway cap-sheet strips over roofing membrane, using same application method as used for roofing cap sheet.

3.10 FIELD QUALITY CONTROL

A. Arrange for roofing system manufacturer to provide following services:
   1. Provide trained technical representative on site for initial three full days of roof installation.
      a. Issue field report within 5 days
      b. Notify Contractor of urgent situations
   2. Provide on-site inspections during roofing installation, every 10 to 14 days.
      a. Issue field report within 5 days of each inspection
      b. Notify Contractor of items requiring immediate attention
   3. At completion of roof work, and within 10 days of Notice of Completion, manufacturer's technical representative shall conduct final inspection of roof system.
      a. Submit detailed report of deficiencies
   4. At completion of roof work, and within 5 days of manufacturer's final inspection, notify Contractor of acceptance or rejection of installed roof system.

B. Testing:
   1. Drain Test: Inspect and test all roof drains for free flow operation.
   2. Pull-Out Test: Contractor shall arrange for manufacturer of approved fasteners to perform pull-out tests on several areas of roof deck to determine proper structural capacity for required roof attachment. Determine minimum number of locations with Architect.
      a. Document and submit results for all test locations
      b. Test results will determine acceptability of roof deck
   3. Final Acceptance Test: As basis of final acceptance of roof system, Owner may have a Roof Moisture Analysis (RMA) of entire roof performed by a roof diagnostic firm.
      a. Testing will be by infrared thermograph and nuclear hydrogen detection.
      b. Detailed report will be supplied.
      c. Contractor shall cooperate with and assist RMA team, including making and repairing any cuts or probes, so as not to void any specified warranties.
      d. RMA shall be performed no more than 20 days after final roof inspection.
      e. Acceptance of roof system is contingent on favorable RMA.

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
   1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

B. Testing Agency: Engage qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to provide reports to Architect.

C. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed roof sheet metal fabrications.
4. Formed wall sheet metal fabrications.

B. Related Requirements:
1. Section 06 1053: Wood nailers, curbs, and blocking.
2. Section 07 7100: Manufactured metal copings and fascias for roof edge securement.
3. Section 07 7200: Set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

C. Coordinate sheet metal flashing and trim installation with other construction to protect the Work during construction period.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
1. Manufactured products. Include material descriptions, standard details, dimensions of individual components and profiles, and finishes.
2. Metal materials.

C. Shop Drawings: Each fabricated component.
1. Include plans, elevations, sections, and attachment details.

2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include locations and details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).
13. Shop Drawings for roof edge securement components required to comply with ANSI/ANSI/SPRI ES-1 shall bear Intertek Testing Services product certification mark labels attesting that those products comply with NRCA certification.

D. Fabrication Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI ES-1 tested.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

B. Manufacturer warranties.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings, roof edge flashings, fascias, and other roof edge securement components required by the building code to conform to ANSI/SPRI ES-1 requirements, shop shall be authorized by NRCA under its certification by Intertek Testing Services ITS.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Protect products against damage, including staining, contact with incompatible substances, and uneven weathering. Store sheet metal roofing materials away from uncured concrete and masonry.

C. Handle metal products to prevent scratching or other abrasion damage, and deformation damage such as dents and kinks. Do not allow metal components to scrape against each other.

D. Provide protective pads for contact points of ladders and tools to prevent direct contact with in-place sheet metal work.

1.9 MANUFACTURER WARRANTIES

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fabricate and install Work of this Section to physically protect membrane roofing, base flashings, joints, and other construction from damage that would permit water leakage into the building and to divert water away from protected joints and construction.

B. Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall be effective to keep water from protected construction during normal weather exposure, including wind design conditions and building movements indicated on Structural Drawings.

C. Sheet Metal Standard for Flashing and Trim: Comply with NRCA "The NRCA Roofing Manual" requirements for dimensions and profiles shown and other applicable recommendations unless more stringent requirements are indicated.

D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to ANSI/SPRI ES-1 and capable of resisting design wind loads.

1. Design Pressures: As indicated on Structural Drawings.

E. Recycled Content: Post consumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
1. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).
2. Exposed Coil-Coated Finish:
   a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Color: As selected by Architect from manufacturer's full range.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
1. Finish: 2B (bright, cold rolled).

D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
1. Surface: Smooth, flat and mill phosphatized for field painting.
2. Exposed Coil-Coated Finish:
   a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.3 UNDERLAYMENT MATERIALS

A. Synthetic Underlayment Sheets: Synthetic fabric sheets for mechanical attachment that are suitable for temperatures over 220 deg F (111 deg C), bitumen-free, have slip-resistant coating, and meet ICC-ES AC188 acceptance criteria for roof underlayment. Supply product with detailing tape, fasteners, and other accessories recommended by underlayment manufacturer for Project applications.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Atlas Roofing Corporation; Summit.
   b. Engineered Coated Products; Nova-Seal II.
   c. Kirsch Building Products, LLC; Sharkskin Comp.
   d. SDP Advanced Polymer Products Inc; Palisade.
   e. Tamko Building Products; Tam-Shield Synthetic Underlayment.

B. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

C. Waterproof Underlayment: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Grace Ice and Water Shield HT.
   c. Henry Company; Blueskin PE200 HT.
   d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
   e. Metal-Fab Manufacturing, LLC; MetShield.
   f. Owens Corning; WeatherLock Specialty Tile & Metal Underlayment.
   g. Polyguard Products, Inc.; Deck Guard HT.
   h. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
   i. SDP Advanced Polymer Products Inc; Palisade SA-HT.
2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.

D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m)minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

A. Solder: ASTM B32; type as recommended by sheet metal roofing reference standard and sheet metal manufacturer for Project applications.

B. Solder:
1. For Stainless Steel: ASTM B 32, Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, with maximum lead content of 0.2 percent.
3. For Zinc: ASTM B 32, with maximum lead content of 0.2 percent, as recommended by zinc manufacturer.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant for Concealed Locations: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
1. Sealants for exposed locations are specified in Section 07 9200.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Fry Reglet Corporation “ST” and “SM, ” or comparable product by one of the following:

a. Cheney Flashing Company.
b. Heckmann Building Products, Inc.
c. Hickman, W. P. Company.
d. Hohmann & Barnard, Inc.
e. Keystone Flashing Company, Inc.
f. National Sheet Metal Systems, Inc.
g. Sandell Manufacturing.

2. Material: Aluminum, 0.024 inch (0.61 mm) thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Accessories:
   a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
6. Finish: With manufacturer's standard color coating.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
1. Gutter Profile: Style A according to cited sheet metal standard.
2. Expansion Joints: Butt type with cover plate.
3. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:
   a. Aluminum: 0.40 (1.02 mm) thick.
4. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:
   a. Aluminum: 0.40 (1.02 mm) thick. Thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Fabricated Hanger Style: Fig 1-35B according to SMACNA's "Architectural Sheet Metal Manual."
2. Fabricate from the following materials:
   a. Aluminum: 0.032 inch (0.80mm) thick.

C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. Aluminum: 0.050 inch (1.27 mm) thick.

D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
1. Aluminum: 0.050 inch (1.27 mm) thick. thick.

E. Splash Pans: Fabricate to dimensions and shape required and from the following materials:
1. Aluminum: 0.040 inch (1.02 mm) thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates. Shop fabricate interior and exterior corners.
1. Joint Style: Butted with expansion space and 6-inch- (150-mm-) wide, concealed back-up plate Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate.
2. Fabricate from the Following Materials:
   a. Galvanized Steel: 0.028 inch (0.71 mm) thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight Shop fabricate interior and exterior corners.
1. Coping Profile: Fig 3-4A according to SMACNA's "Architectural Sheet Metal Manual."
2. Joint Style: Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate.
3. Fabricate from the Following Materials:
   a. Aluminum: 0.050 inch (1.27 mm) thick.

C. Roof and Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials: Shop fabricate interior and exterior corners.
1. Aluminum: 0.025 inch (0.64 mm) thick.

D. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum: 0.040 inch (1.02 mm) thick.

E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum: 0.032 inch (0.81 mm) thick.

F. Flashing Receivers: Fabricate from the following materials:
1. Aluminum: 0.032 inch (0.81 mm) thick.

2.9 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
1. Aluminum: 0.032 inch (0.81 mm) thick.

B. Wall Expansion-Joint Cover: Fabricate from the following materials:
1. Aluminum: 0.040 inch (1.02 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Waterproof Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

B. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
   1. Apply on roof not covered by self-adhering sheet underlayment.

C. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

A. Comply with applicable requirements of Section 01 7300.

B. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
   5. Torch cutting of sheet metal flashing and trim is not permitted.

6. Do not use graphite pencils to mark metal surfaces.

C. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

D. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
1. Use lapped expansion joints only where indicated on Drawings.

E. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

F. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

G. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

H. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel and aluminum sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

I. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
   1. Fasten gutter spacers to front and back of gutter.
   2. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.
   3. Anchor gutter with gutter brackets spaced not more than 24 inches (600 mm) apart to roof deck, unless otherwise indicated, and loosely lock to front gutter head.
   4. Install gutter with expansion joints not exceeding, 50 feet (15.24 m) apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints.
   1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
   2. Connect downspouts to underground drainage system.

D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.

E. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   1. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch (25 mm) below scupper discharge.

G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Metal roof edge securement components, except gutters, shall be installed as tested in accordance with ANSI\SPRI ES-1, American National Standard for Edge Systems Used with Low-Slope Roofing Systems."
   1. Roof Edge Flashing: Anchor to resist uplift and outward forces. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.

C. Copings: Anchor to resist uplift and outward forces.
   1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) centers.
   2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch (600-mm) centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm). Secure in waterproof manner by means of snap-in installation and sealant or interlocking folded seam or blind rivets and sealant unless otherwise indicated.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."

C. Reglets: Installation of reglets is specified in Section 042000 "Unit Masonry."

D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Remove excess solder.

C. Remove excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

B. Related Requirements:
1. Section 03 3000: Installation of reglets in concrete.
2. Section 06 1000: Wood nailers, curbs, and blocking.
3. Section 07 4113.16: Roof-edge drainage-system components provided by metal-roof-panel manufacturer.
4. Section 07 6200: Custom- and site-fabricated sheet metal flashing and trim.

C. Preinstallation Conference: Conduct conference at Project site per requirements of Section 01 3100.
1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.
5. Include statement indicating cost for each product having recycled content.

C. Shop Drawings:
1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

E. Samples for Verification:
   1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
   2. Include copings, roof-edge specialties, roof-edge drainage systems, reglets and counter-flashings made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

B. Manufacturer warranties.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 07 5216, “SBS Modified Bituminous Membrane Roofing.”

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

C. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.6 FIELD CONDITIONS

A. Field Measurements: Measure in-place construction as needed for fabrication and execution. No changes to Contract Sum or Contract Time will be allowed for differences between Drawing dimensions and field measurements.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 07 5216, “SBS Modified Bituminous Membrane Roofing.”

B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Recycled Content: Post consumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Architectural Product Co.; AP Snap Tight Coping or comparable product by one of the following:
   a. ATAS International, Inc.
   b. Castle Metal Products.
   c. Cheney Flashing Company.
   d. Hickman Company, W. P.
   e. Merchant & Evans, Inc.
   f. Metal-Era, Inc.
   g. Metal-Fab Manufacturing, LLC.
   h. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
   i. Petersen Aluminum Corporation.
2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, thickness as required to meet performance requirements.
   a. Surface: Smooth, flat finish.
   b. Finish: Three-coat fluoropolymer.
   c. Color: As selected by Architect from manufacturer's full range.
3. Corners: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.

a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.

2.3 ROOF-EDGE SPECIALTIES

A. Canted Roof-Edge Gravel Stop: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed galvanized-steel sheet cant, 0.028 inch (0.71 mm) thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Architectural Products Co.; AP Standard Gravel Stop and Accessories or comparable product by one of the following.
   a. ATAS International, Inc.
   b. Castle Metal Products.
   c. Cheney Flashing Company.
   d. Hickman Company, W. P.
   e. Merchant & Evans, Inc.
   f. Metal-Era, Inc.
   g. Metal-Fab Manufacturing, LLC.
   h. Petersen Aluminum Corporation.
2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, thickness as required to meet performance requirements.
   a. Surface: Smooth, flat finish.
   b. Finish: Three-coat fluoropolymer.
   c. Color: As selected by Architect from manufacturer's full range.
3. Corners: Factory mitered and continuously welded.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Fascia Accessories: Fascia extenders with continuous hold-down cleats. Downspout scuppers with integral conductor head and downspout adapters.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Architectural Products Company, Formed AP Gutters and Downspouts or comparable product by one of the following:

1. ATAS International, Inc.
2. Berger Building Products, Inc.
3. Castle Metal Products.
4. Cheney Flashing Company.
5. CopperCraft by FABRAL; a Euramax company.
6. Hickman Company, W. P.
7. Merchant & Evans, Inc.
8. Metal-Era, Inc.
9. Metal-Fab Manufacturing, LLC.
10. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Aluminum Sheet: 0.040 inch (1.02 mm) thick.
2. Gutter Profile: Style A according to SMACNA's "Architectural Sheet Metal Manual."
3. Corners: Factory mitered and continuously welded.
4. Gutter Supports: Gutter brackets with finish matching the gutters.

C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Formed Aluminum: 0.040 inch (1.02 mm) thick.

D. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof.
1. Formed Aluminum: 0.050 inch (1.27 mm) thick.

E. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim, and built-in overflow.
1. Formed Aluminum: 0.050 inch (1.27 mm) thick.

F. Splash Pans: Fabricate from the following exposed metal:
1. Formed Aluminum: 0.040 inch (1.02 mm) thick.

2.5 REGLETS AND COUNTERFLASHINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Fry Reglet Corporation; “ST” type or comparable product by one of the following:
1. Castle Metal Products.
2. Cheney Flashing Company.
3. Heckmann Building Products Inc.
4. Hickman Company, W. P.
5. Keystone Flashing Company, Inc.
6. Metal-Era, Inc.
7. Metal-Fab Manufacturing, LLC.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Formed Aluminum: 0.025 inch thick.
2. Corners: Factory mitered and continuously welded.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

C. Accessories:
1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.

D. Aluminum Finish**:** Three-coat fluoropolymer.
   1. Color: As selected by Architect from manufacturer's full range.

2.6 MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

2.7 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F (116 deg C).
   2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F (29 deg C).
   3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
      b. Grace Construction Products, a unit of W. R. Grace & Co.; Grace Ice and Water Shield HT.
      c. Henry Company; Blueskin PE200 HT.
      d. Metal-Fab Manufacturing, LLC; MetShield.
      e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

B. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum.

2.8 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
   1. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

B. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

C. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.9 FINISHES

A. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Aluminum Sheet Finishes:
1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if recommended by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
1. Apply continuously under copings, roof-edge specialties, and reglets and counterflashings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.3 INSTALLATION, GENERAL

A. Comply with applicable requirements of Section 01 7300.

B. Anchor roof specialties rigidly and securely in place, with provisions for thermal and structural movement.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

C. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

D. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
   1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
   2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

E. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

F. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

G. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.4 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
   1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.
   2. Interlock face-leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements .

3.5 ROOF-EDGE SPECIALTIES INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches (610 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
   1. Install gutter with expansion joints at locations indicated but not exceeding 40 feet (12.16 m) apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o/c.
   1. Connect downspouts to underground drainage system indicated.

D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement.

E. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
   2. Loosely lock front edge of scupper with conductor head.

F. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch (25 mm) below scupper discharge.

3.7 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.

C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints minimum 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bellows-type roof expansion joints.

B. Related Requirements:
   1. Division 06 Section "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
   2. Division 07 Section "SBS Modified Bitumen Roofing" for roofing system.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.

1.2 ACTION SUBMITTALS

A. Shop Drawings: For roof expansion joints.
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
   3. Provide isometric drawings of intersections, terminations, and changes in joint direction or planes, depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

B. Samples: For each exposed product and for each color specified, 6 inches (150 mm) in size.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roofing membrane.

1.4 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Roof expansion joints shall withstand exposure to weather, remain watertight, and resist the movements indicated without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 BELLOWS-TYPE ROOF EXPANSION JOINTS

A. Source Limitations: Obtain bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.

B. Flanged Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly, consisting of exposed membrane bellows, laminated to flexible, closed-cell support foam, and secured along each edge to a 3- to 4-inch- (76- to 100-mm-) wide metal flange for nailing to substrate. Provide each size and type indicated, factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Balco, Inc.; Type BRBG-CE, Roof Bellows.
   b. C/S Group; Model BRJW.
   c. InPro Corporation; 674 Series.
   d. Johns Manville; a Berkshire Hathaway company; Style EJ/WC,; Expand-O-Flash.
   e. Watson Bowman Acme Corp; Model EEJ.
2. Joint Movement Capability: Plus and minus 50 percent of joint size.
3. Bellows: EPDM flexible membrane, nominal 60 mils (1.5 mm) thick.
   a. Color: Black.
4. Flanges: Galvanized steel, 0.022 inch (0.56 mm) thick or aluminum, 0.032 inch (0.81 mm) thick.
   a. Form: Angle formed to fit curbs as indicated on Drawings.
5. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary bellows assembly.
   a. Thermal Insulation: Fill space above secondary seal with mineral-fiber blanket insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.
6. Fire Barrier: Manufacturer's standard fire-resistive joint system with ratings determined per ASTM E 1966 or UL 2079 to resist spread of fire and to accommodate building thermal movements without impairing its ability to resist the passage of fire and hot gases.

2.3 MATERIALS

A. Galvanized-Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90 (Z275).

B. Aluminum: ASTM B 209 (ASTM B 209M) for sheet and plate, ASTM B 221 (ASTM B 221M) for extrusions; alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.

2. Mill Finish: As manufactured.

C. EPDM Membrane: ASTM D 4637, Type standard with manufacturer for application.

D. Silicone Extrusions: ASTM D 2000, UV stabilized, and that does not propagate flame.

E. Adhesive: As recommended by roof-expansion-joint manufacturer and that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for Testing Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
   a. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.

G. Mineral-Fiber Blanket: ASTM C 665.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine roof-joint openings, inside surfaces of parapets, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for handling and installing roof expansion joints.
   1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
   2. Install roof expansion joints true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
   3. Provide for linear thermal expansion of roof expansion joint materials.
   4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
   5. Provide uniform, neat seams.
   6. Install roof expansion joints to fit substrates and to result in watertight performance.
   7. Torch cutting of roof expansion joints is not permitted.

8. Do not use graphite pencils to mark aluminum surfaces.

B. Directional Changes and Other Expansion-Control Joint Systems: Coordinate installation of roof expansion joints with other expansion-control joint systems to result in watertight performance. Install factory-fabricated units at directional changes and at transitions between roof expansion joints and exterior expansion-control joint systems specified in Division 07 Section "Expansion Control" to provide continuous, uninterrupted, and watertight joints.

C. Splices: Splice roof expansion joints with materials provided by roof-expansion-joint manufacturer for this purpose, to provide continuous, uninterrupted, and waterproof joints.
1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.

D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

3.3 PROTECTION

A. Protect roof expansion joints from foot traffic, displacement, or other damage.

B. Remove and replace roof expansion joints and components that become damaged by moisture or otherwise.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Silicone joint sealants
   2. Urethane joint sealants.
   3. Latex joint sealants.
   4. Acoustical joint sealants.

B. Related Sections:
   1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
   2. Division 07 Section "Expansion Control" for building expansion joints.
   3. Division 08 Section "Glazing" for glazing sealants.
   4. Division 09 Section "Gypsum Board" for sealing perimeter joints.
   5. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each application indicated below:
      a. Each kind of sealant and joint substrate indicated.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
         1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

1. Submit all sealants, interior and exterior, for review in a single group as required by Section 01 3300, regardless of how many subcontractors will install sealants. Multiple submittals for sealants are not acceptable.

B. Product Data: Each required type of sealant.
   1. Include manufacturer's written adhesion and compatibility preconstruction test results and specific primer and procedure recommendations for indicated substrates.

C. Samples: Cured samples of actual materials in available standard sealant color selections. Where custom color is required, re-submit samples until desired color is achieved.

D. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

E. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

F. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Field-Adhesion Test Reports: For each sealant application tested.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturer warranties.

1.6 QUALITY ASSURANCE

A. Sole Source Requirements: Provide only one brand of sealant for each required type, regardless of the number of applicators.

B. Installer Qualifications for Elastomeric Sealants: Skilled workers experienced in applying specified sealants and backing materials.
   1. Exterior Joint Sealants: Specialized firm with minimum 5 years' successful experience in applying specified types of sealants on projects of similar type and size.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

D. Sample Applications: Provide sample applications of exposed elastomeric sealants for following applications to demonstrate workmanship and appearance, and to be comparison standard for judging completed Work . Apply samples in locations acceptable to Architect. Do not proceed with remaining Work until approved by Architect.

1. Exterior building joints between similar and dissimilar materials.
2. Interior sealant joints in floors, ceilings, tile**.**

E. Preinstallation Conferences: Conduct conferences at Project site to discuss application of the following.
1. Exterior exposed elastomeric sealants.
2. Interior exposed elastomeric sealants.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C**)**].
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250g/L.
   2. Sealant Primers for Nonpourous Substrates: 250g/L.
   3. Sealant Primers for Porous Substrates: 775g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 790.
      b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
      c. May National Associates, Inc.; Bondaflex Sil 290.
      d. Pecora Corporation; 890NST.
      e. Sika Corporation, Construction Products Division; SikaSil-C990.
      f. Tremco Incorporated; Spectrem 1.

B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 799.
      b. GE Advanced Materials - Silicones; UltraGlaze SSG4000.
      c. May National Associates, Inc.; Bondaflex Sil 200 GPN.
      d. Tremco Incorporated; Tremsil 600.

C. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corporation; 898.
      b. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Building Systems; Sonolastic Ultra.
      b. May National Associates, Inc.; Bondaflex PUR 25.
      c. Pecora Corporation; Dynatrol I-XL.
      d. Polymeric Systems, Inc.; Flexiprene 1000.

e. Sika Corporation, Construction Products Division; Sikaflex - 1a.
f. Tremco Incorporated; Vulkem 116.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolac.
b. May National Associates, Inc.; Bondaflex Sil-A 700.
c. Pecora Corporation; AC-20+.
d. Tremco Incorporated; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Pecora Corporation; AC-20 FTR.
b. USG Corporation; SHEETROCK Acoustical Sealant.
2. Exception: Where acoustical seals are needed at copper pipe penetrating gypsum board, provide one-part urethane sealant in white color; ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or

harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Limestone.
      d. Unglazed surfaces of ceramic tile.
      e. Exterior stucco systems.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with applicable requirements of Section 01 7300.

B. Performance Requirements for Installation:
1. Exterior joint sealants shall provide continuous, weatherproof seals to prevent infiltration of air and water through the joints in which they are installed.
2. Interior joint sealants shall provide continuous seals to prevent air and smoke infiltration through the joints in which they are installed. Sanitary sealant shall also prevent water infiltration.

C. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

D. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

E. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

F. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

G. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
   1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
   2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
   3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
   4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, 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.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 2 tests for each kind of sealant and joint substrate.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
   4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
   5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other

requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Joints between metal panels.
      b. Perimeter joints between materials listed above and frames of doors and windows.
   2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 25**.**
   3. Joint-Sealant Color: Match adjacent material color designated by Architect and as selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Joints in dimension stone veneer.
      b. Joints in exterior stucco finish systems.
      c. Joints between different materials listed above.
      d. Perimeter joints between materials listed above and frames of doors and windows.
      e. Other joints as indicated.
   2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50**.**
   3. Joint-Sealant Color: Match adjacent material color designated by Architect and as selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Sealant Location:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
      c. Other joints as indicated.
   2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.

3. Joint-Sealant Color: Match adjacent material color designated by Architect and as selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
   2. Urethane Joint Sealant: Single component, nonsag, nontraffic grade, Class 25.
   3. Joint-Sealant Color: Match adjacent material color designated by Architect and as selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      b. Joints at top of floor base cap trim.
      c. Other joints as indicated.
   2. Joint Sealant: Latex.
   3. Joint-Sealant Color: Match adjacent material color designated by Architect and as selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Location:
      a. Acoustical joints where indicated.
      b. Other joints as indicated.
   2. Joint Sealant: Acoustical.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior wall expansion control systems.

B. Related Requirements:
   1. Section 07 7129: Roof expansion joints.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples for Initial Selection: For each type of expansion control system indicated.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches (150 mm) long in size.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
   2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

B. Coordination: Coordinate installation of exterior wall expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.2 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.

2. Balco, Inc.
3. Chase Construction Products; Division of Chase Corporation.
4. Construction Specialties, Inc.
5. D. S. Brown Company (The).
6. EMSEAL Corporation.
7. Erie Metal Specialties, Inc.
8. JointMaster/InPro Corporation.
9. LymTal International, Inc.
10. Michael Rizza Company, LLC.
11. MM Systems Corporation.
12. Nystrom, Inc.
13. RJ Watson, Inc.
14. Schul International Company, Inc.
15. Tremco Incorporated.
16. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.
17. Williams Products, Inc.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall Corner:
1. Design Criteria:
   a. Nominal Joint Width: 1 inch.
   b. Movement Capability: -25 percent/+75 percent.
2. Type: Preformed cellular foam.
   a. Foam Material: Manufacturer's standard.
      1) Color: Manufacturer's standard.

2.3 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover.
1. Drain-Tube Assemblies: Equip moisture barrier with drain tubes and seals to direct collected moisture to drain.

2.4 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Elastomeric Seals: ASTM E 1783; performed elastomeric members or extrusions to be installed in metal frames.

C. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

D. Moisture Barrier: Flexible elastomeric material, EPDM, minimum 45 mils thick.

E. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

3.3 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
   3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   4. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.

5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
   1. Provide in continuous lengths for straight sections.
   2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
   3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

E. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings. Provide drainage fittings at a maximum of 50 feet (15.2 m) or where indicated on Drawings.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals before Substantial Completion of the Work.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standard hollow metal doors and frames.

B. Related Requirements:
   1. Section 08 3449 "Radiation Shielding Doors and Frames".
   2. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.
   3. Section 08 8000 "Glazing" for glass installed in hollow metal doors and frames.

1.2 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, and finishes.

C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

D. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.

C. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

D. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Amweld International, LLC.
   2. Ceco Door Products; an Assa Abloy Group company.
   3. Curries Company; an Assa Abloy Group company.
   4. Fleming-Baron Door Products.
   5. Steelcraft; an Ingersoll-Rand company.
   6. Apex Industries, Inc.
   7. Deansteel.
   8. de La Fontaine Industries.
   9. HMF Express.
   10. Hollow Metal Inc.
   11. Hollow Metal Xpress.
   12. J/R Metal Frames Manufacturing, Inc.
   13. Karpen Steel Custom Doors & Frames.
   14. L.I.F. Industries, Inc.
   15. LaForce, Inc.
   16. Megamet Industries, Inc.
   17. Mesker Door Inc.
   18. Michbi Doors Inc.
   19. MPI Group, LLC (The).
   20. National Custom Hollow Metal.
   21. North American Door Corp.
   22. Republic Doors and Frames.
   23. Rocky Mountain Metals, Inc.
   24. Shanahans Manufacturing Ltd.
   25. Trillium Steel Doors Limited.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 INTERIOR FRAMES

A. Standard-Duty Frames: SDI A250.8, Level 1. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level C according to SDI A250.4.
2. Frames:
   a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch (1.0 mm).
   b. Construction: Knocked down.
3. Exposed Finish: Factory-applied primer.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches (44.5 mm.)
      c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
      d. Edge Construction: Model 2, Seamless.
      e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
   3. Frames:
      a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
      b. Construction: Full profile welded.
   4. Exposed Finish: Factory-applied primer.

2.4 FRAME ANCHORS

A. Jamb Anchors:
   1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
   2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) hot-dip galvanized coating.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:
   1. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
   2. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
   3. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
   4. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   5. Glazed Lites: Factory cut openings.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   3. Grout Guards: Weld guards to frame at back of all hardware mortises.
   4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
   5. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
   1) Three anchors per jamb up to 60 inches (1524 mm) high.
   2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
   3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
   4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.

6. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplate, mortised, and surface-mounted door hardware.
2. Provide extra heavy duty 0.167-inch hinge reinforcement at all hinges.
3. Provide continuous reinforcement at continuous hinges with 0.167-inch steel plate spot welded to back side of frame.
4. Provide minimum 0.093-inch continuous sleeve closer reinforcement.
5. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplate, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
   1. Install exterior doors and frames in accordance with Florida Product Control Notice of Approval for approved submittal.

C. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. Install frames with removable stops located on secure side of opening.
   b. Install door silencers in frames before grouting.
   c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   e. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
5. Surface Preparation: After installation, fill seams flush with polyester body putty, sand smooth, and touch up primer to provide seamless appearance.

D. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Steel Doors:
   a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
   c. At Bottom of Door: 3/4 inch (19.1 mm) plus or minus 1/32 inch (0.8 mm).
   d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

E. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-core doors with wood-veneer faces.
   2. Shop priming flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
   1. Section 08 1113 "Hollow Metal Doors and Frames.
   2. Section 08 8000 "Glazing" for glass view panels in flush wood doors.
   3. Section 09 9123 "Interior Painting" and Section 09 9300 "Staining and Transparent Finishing" for field finishing doors.
   4. Section 13 4900 "Radiation Protection" for lead-lined flush wood doors.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking.
   2. Dimensions and locations of mortises and holes for hardware.
   3. Dimensions and locations of cutouts.
   4. Undercuts.
   5. Requirements for veneer matching.
   6. Doors to be factory finished and finish requirements.
   7. Fire-protection ratings for fire-rated doors.

D. Flush Wood Door Schedule: Use same reference designations indicated on drawings in preparing schedule for doors and frames.

E. Samples for Verification:
   1. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
      a. Provide Samples for each species of veneer and solid lumber required.
      b. Provide Samples for each color, texture, and pattern of plastic laminate required.
      c. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
   2. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.

3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Comply with requirements of referenced standard and manufacturer's written instructions.

C. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

D. Mark each door on top and bottom rail with opening number used on Shop Drawings.

A. Either before or upon delivery to job site, all edges of the doors must be sealed using type of sealer recommended by door manufacturer.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 MANUFACTURER WARRANTIES

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Algoma Hardwoods, Inc.
   2. Ampco.
   3. Chappell Door Co.
   4. Eggers Industries.
   5. General Veneer Manufacturing Co.
   6. Graham Wood Doors; an Assa Abloy Group company.
   7. Lambton Doors.
   8. Marlite.
   9. Marshfield Door Systems, Inc.

10. Mohawk Doors; a Masonite company.
11. Oshkosh Door Company.
12. VT Industries, Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI**.**
   1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

B. Regional Materials: Flush wood doors shall be manufactured within 500 miles (800 km) of Project site.

C. Low-Emitting Materials: Fabricate doors with adhesives that do not contain urea formaldehyde and with composite wood products that have no added urea formaldehyde NAUF material.

D. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. WDMA I.S.1-A Performance Grade:
   1. Heavy Duty unless otherwise indicated.
   2. Extra Heavy Duty: Public toilets, janitor's closets exits and exam rooms and where indicated.
   3. Standard Duty: Closets (not including janitor's closets) and where indicated.

F. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing and made with no added urea-formaldehyde.
   2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware or as follows:
      a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
      b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
      c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
   1. Grade: Custom (Grade A faces).
   2. Species: Select white birch.
   3. Cut: Plain sliced (flat sliced).
   4. Match between Veneer Leaves: Book match.
   5. Assembly of Veneer Leaves on Door Faces: Balance match.
   6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

7. Exposed Vertical Edges: Same species as faces - edge Type A.
8. Core: Particleboard.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Manufacturer's standard shape.

B. Metal Louvers:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Air Louvers, Inc.
      b. Anemostat; a Mestek company.
      c. L & L Louvers, Inc.
      d. Louvers & Dampers, Inc.; a division of Mestek, Inc.
      e. McGill Architectural Products.
   2. Blade Type: Vision-proof, inverted V.
   3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, with baked-enamel- or powder-coated finish.
   4. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
   5. Metal and Finish: Extruded aluminum with dark bronze, Class II, color anodic finish, AA-M12C22A32/A34.

2.5 FABRICATION

A. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

B. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
   3. Louvers: Factory install louvers in prepared openings.

2.6 SHOP PRIMING

A. Doors for Transparent Finish: Shop prime faces and all four edges with stain (if required), other required pretreatments, and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing." Seal edges of cutouts and mortises with first coat of finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Hardware: For installation, see Section 087100 "Door Hardware."

C. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames for walls and ceilings.

B. Related Requirements:
   1. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details materials, individual components and profiles, and finishes.

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
   2. Karp Associates, Inc.
   3. Larsen's Manufacturing Company.
   4. Milcor Inc.
   5. Nystrom, Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:
   1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.

2. Locations: Wall and ceiling.
3. Door Size: As required for each access location.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage.
   a. Finish: Factory prime.
5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Spring-loaded, concealed-pin type.
7. Hardware: Latch.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Frame Anchors: Same type as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder locks, furnish two keys per lock and key all locks alike.

2.4 FINISHES

A. Steel Finishes:
   1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel hollow-metal doors and door frames.
2. Observation-window frames.
3. Neutron-shielding doors, frames, and hardware.

B. Related Sections:
1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 099123 "Interior Painting" for field finishing doors and frames.

1.2 PERFORMANCE REQUIREMENTS

A. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.
1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.

B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, and glazed opening frames located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.

C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: Radiation shielding doors and frames.

C. Shop Drawings: Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.
1. Schedule of radiation shielding doors and door and observation window frames, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
2. Door and frame elevations.
3. Details of doors, including vertical and horizontal edge details and metal thicknesses.
4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
5. Locations of reinforcement and preparations for hardware.
6. Details of anchorages, joints, field splices, and connections.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

9. Show details of neutron-shielding doors and frames, including anchorage to and coordination with other work. Show locations of electrical conduit and boxes for connecting door operators, door operator switches, and door interlock switches.
    a. Wiring diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For neutron-shielding doors to include in operation and maintenance manuals.

B. Manufacturer warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Source Limitations: Obtain each type of radiation protection product from single source from single manufacturer unless otherwise indicated.

C. Glazing: Comply with applicable requirements in Section 08 8000 "Glazing."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to radiation protection, including:
    a. Sequence and schedule of radiation shielding doors and frames in relation to other radiation protective construction.
    b. Requirements for field quality control.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Lead-Lined Steel Doors and Frames: Deliver doors and frames cardboard wrapped or crated to provide protection during delivery and storage. Inspect for damage on delivery. Minor damage may be repaired provided refinished repairs match new work and are approved by Architect; otherwise, remove and replace damaged items as directed.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install products until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lead Sheet, Strip, and Plate: ASTM B 749, alloy UNS No. L51121 (chemical-copper lead).

B. Borated Polyethylene: Manufactured specifically for neutron shielding and containing not less than 5 percent boron.

C. Grout: ASTM C 476, with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
   1. For grouting frames of neutron-shielding doors, use coarse grout made from aggregate having a density not less than that used for concrete walls in which frames are installed.

D. Accessories and Fasteners: Provide manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.

E. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 LEAD-LINED STEEL HOLLOW-METAL DOORS

A. General: Steel doors complying with ANSI/NAAMM-HMMA 861, except with a single continuous sheet of lead of thickness not less than that required for partition in which door is installed and extending from top to bottom and edge to edge, installed either between back-to-back stiffeners or between stiffeners and stop face of door.
   1. Manufacturers: Basis-of-Design; Radiation Protection Products, Inc.; Scott Valene 952-345-3083; www.RPPinc.com, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. A & L Shielding Inc.
      b. El Dorado Metals, Inc.
      c. NELCO, Inc.
      d. New Shield, Inc.
      e. Ray-Bar Engineering Corp.
      f. Karpen Steel Custom Doors & Frames.
      g. New Shield.
      h. Pitts Little Radiation Shielding.
   2. Line inverted channels at top and bottom of doors with lead sheet of same thickness used in door and close with filler channels to provide flush top and bottom edges.
   3. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining 1 inch (25 mm).
   4. Factory fit doors to suit frame-opening sizes indicated with 1/16-inch (1.5-mm) clearance at heads and jambs and minimum clearance at bottom.
   5. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.3 LEAD-LINED STEEL HOLLOW-METAL DOOR FRAMES

A. General: Steel door frames complying with ANSI/NAAMM-HMMA 861, and lined with lead sheet of thickness not less than that required for doors and walls where frames are used.
   1. Manufacturers: Basis-of-Design; Radiation Protection Products, Inc.; Scott Valene 952-345-3083; www.RPPinc.com, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. A & L Shielding Inc.
      b. New Shield, Inc.
      c. Ray-Bar Engineering Corp.
      d. Karpen Steel Custom Doors & Frames.
      e. Aaccurate Radiation Shielding, Inc.
      f. Fluke Biomedical; Radiation Management Services.
      g. Pitts Little Radiation Shielding.
   2. Provide additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
   3. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
   4. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
      a. Color and Gloss: Match Architect's sample.

2.4 NEUTRON-SHIELDING DOORS AND FRAMES

A. General: Steel plate doors lined with lead and borated polyethylene and hung from structural-steel door frames.
   1. Manufacturers: Basis-of-Design; Radiation Protection Products, Inc.; Scott Valene 952-345-3083; www.RPPinc.com, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Aaccurate Radiation Shielding, Inc.
      b. A & L Shielding Inc.
      c. New Shield.
      d. Ray-Bar Engineering Corp.
      e. Pitts Little Radiation Shielding.
   2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   3. Door Construction: Fabricate from 1/4-inch- (6-mm-) thick steel plate faces, reinforced at hinge locations, and 1/2-inch- (13-mm-) thick, steel flat-bar edges fully welded together. Continuously weld exposed joints and finish smooth, matching adjacent surfaces.
      a. Apply filler to interior of door faces to provide smooth, even surfaces for applying lead and polyethylene. Bond lead to interior of door face with permanent adhesive.
      b. Install lead in one piece and polyethylene in single or multiple sheets, all full height and width of door interior.
   4. Door Frame Construction: Fabricate from 1/4-inch- (6-mm-) thick steel plate to dimensions indicated, fully welded together. Continuously weld exposed joints and finish smooth, matching adjacent surfaces.

a. Fabricate frames with depth equal to thickness of shielding wall in which door is installed. Rabbet frame to receive door and to provide a 4-inch (100-mm) overlap between door edges and remaining frame depth. Make frame faces 4 inches (100 mm) wide with 3/4-inch- (19-mm-) deep backbends.
b. Reinforce frames and drill and tap as needed to accept finish hardware.
c. Provide steel strap anchors using 1/8-by-2-inch- (3-by-50-mm-) wide straps of length required for a minimum 8-inch (200-mm) embedment. Weld anchors to frame members not more than 8 inches (200 mm) from both bottom and top of jambs and from ends of head, and space anchors not more than 24 inches (600 mm) apart.
d. Provide channel-shaped sill fabricated from 1/4-inch- (6-mm-) thick steel plate lined with lead. Make sill 1-1/2 inches (38 mm) deep by same width as jambs and weld to door jambs.

5. Shop-Primed Finish: Prepare ferrous-metal surfaces to comply with SSPC-SP 3 (Power Tool Cleaning) and apply an alkyd primer complying with MPI#79.
   a. Stripe paint corners, crevices, bolts, welds, and sharp edges.
6. Hardware: Provide the following hardware for each door:
   a. Hinges: BHMA A156.1, Type A8391; weld- or bolt-on type at manufacturer's option; sized for door weight; two or three per door at manufacturer's option.
   b. Pulls: BHMA A156.6, Type J401, two per door.
   c. Operator: Power-opening and spring- or power-closing unit; with automatic hold-open; complying with BHMA A156.10; sized for door weight and width; and adjustable for opening, closing, and checking speeds. Unit shall have an emergency release to allow door to be opened manually and a disconnect switch to prevent power operation when door is in emergency-release mode.
   d. Controls: Provide two wall-mounted, recessed, push-plate switches for opening door and one push-button switch for closing door. Provide motion or presence sensors to detect persons or objects in path of door and, if these are detected, to stop and reverse action of door operator.
7. Door Interlock Switch: Provide electric switch in frame jamb to prevent operation of radiation therapy equipment when door is open and to shut off power to equipment if door is opened while equipment is in use.
   a. Provide rough box for installing switch, fabricated from 1/4-inch- (6-mm-) thick steel plate welded to frame and lined on all sides with 1/4-inch- (6-mm-) thick lead plate.

2.5 DOOR AND DOOR FRAME FABRICATION

A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 "Door Hardware."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

A. Install lead-lined steel doors and door frames according to applicable requirements of Section 081113 "Hollow Metal Doors and Frames."

B. Frames: Comply with HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.
   1. Provide three anchors per jamb, located adjacent to hinge on hinge jamb and at corresponding heights on strike jamb.
   2. In metal stud construction, use wall anchors attached to studs with screws.

C. Lap lead lining of frames over lining in walls at least 1 inch (25 mm).

D. Install doors in frames level and plumb, aligned with frames and with uniform clearance at each edge.

E. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Section 087100 "Door Hardware" for other installation requirements.

F. Touch up damaged finishes with compatible coating after sanding smooth.

G. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

3.3 INSTALLATION OF LEAD-LINED OBSERVATION WINDOWS

A. Install observation windows according to manufacturer's written installation instructions.

B. Install windows level, plumb, square, true to line, and anchored securely in place to structural support.

C. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least 1 inch (25 mm).

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with manufacturer's written instructions.

3.4 INSTALLATION OF NEUTRON-SHIELDING DOORS AND FRAMES

A. Install frames in concrete forms before concrete is placed. Adjust frames as needed so they are square and within 1/16 inch (1.5 mm) of plumb. Secure frames to forms and brace to resist forces resulting from concrete placement.

B. Install frames in concrete openings and adjust as needed so they are square and within 1/16 inch (1.5 mm) of plumb. Secure frames to concrete and brace to resist forces resulting from

weight and movement of shielding door. Grout frames, consolidating grout to solidly fill spaces between frame and opening.

C. Install doors in frames and install door operators, door controls, interlock switches, and other components according to manufacturer's written instructions and Shop Drawings.

D. Touch up damaged primer with compatible coating after sanding smooth.

E. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operators and controls for opening, closing, latching, and back-checking speeds and for open- and closed-door positions.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.

B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.

3.6 PROTECTION

A. Lock radiation-protected rooms once doors and locks are installed and limit access to only those persons performing work in the rooms.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior Interior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for ribbon walls.
4. Storefront framing for punched openings.
5. Exterior manual-swing entrance doors.
6. Hardware for glazed aluminum doors.

B. Related Requirements:
1. Section 07 6200: Requirements for fabricating sheet metal trim and flashing.
2. Section 08 7100: Door Hardware.
3. Section 08 8000: Glass installed in storefront system.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site per requirements of Section 01 3100.

B. Conduct conference as part of preinstallation conference for curtain wall system.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Special Requirements: Transmit required submittals concurrently with submittals for the curtain wall system.

C. Product Data: Storefront framing, aluminum entrance doors.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

D. Shop Drawings:
1. Include plans, elevations, sections, and full-size details.
2. Include details of attachments to other work. Include coordination with metal stud framing for exterior walls.
3. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
4. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.
5. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

6. Show weep locations.
7. Show sheet metal trim.
8. Show extruded trim.
9. Show how system is sealed to adjacent weather resistive barrier membranes.

E. Samples for Initial Selection: Available standard colors.

F. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

G. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

H. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

I. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Impact Resistance Data: Manufacturer’s current Product Approval Notice indicating product acceptance in accordance with requirements of the Florida Building Code. Notice of Approval shall indicate as a minimum, product control number, expiration date of approval, and the specific conditions governing the approval.

B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturer warranties.

B. Maintenance Data: Doors, hardware, system finish.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installers and supervisors who are trained and approved by manufacturer.

B. Accessibility Requirements: Comply with applicable provisions in Department of Justice *2010 ADA Standards for Accessible Design* and Florida Accessibility Code for Building Construction.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 MOCKUPS

A. Mockups: Build mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Photograph installation of sill flashing with end dams and other concealed components. Provide access to record photographs when requested by Architect.
   3. Testing shall be performed on mockup according to requirements in "Field Quality Control" Article.
   4. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   5. Subject to compliance with requirements, approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage qualified professional engineer, as defined in Section 014000 "Quality Requirements," who is registered in the state in which Project is located to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

C. Structural Loads:
1. Wind Loads: Indicated on Structural Drawings.
2. Other Design Loads: Indicated on Structural Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
   a. Operable Units: Provide minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
   a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 11 feet 8-1/4 inches (3.6 m) or 1/175 times span, for spans less than 11 feet 8-1/4 inches (3.6 m).

E. Structural: Tested per ASTM E 330 as follows.
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Fixed Framing and Glass Area:
      a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
   2. Entrance Doors:
      a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested according to minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
   2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer IR 501 or comparable product by one of the following:
   1. Arcadia, Inc.
   2. Arch Aluminum & Glass Co., Inc.
   3. CMI Architectural.
   4. EFCO Corporation.
   5. Leed Himmel Industries, Inc.
   6. Oldcastle BuildingEnvelope.
   7. Pittco Architectural Metals, Inc.
   8. TRACO.
   9. Tubelite.
   10. United States Aluminum.
   11. YKK AP America Inc.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Nonthermal.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Glazing Installation: Exterior.
5. Weep System: Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
6. Finish: Clear anodic finish.
7. Profile Dimensions: 2-1/2 inches by 5 inches.
8. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.
3. Glazing Stops and Gaskets: Rectangular, snap-on, extruded-aluminum stops and preformed gaskets.

2.5 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article for each entrance door to comply with requirements in this Section.
1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:
   a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N)to set the door in motion.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.

A. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles; fabricated to full height of door and frame.
1. Finish hinges to match door finish.
2. Manufacturers:
   a. Hager Companies.
   b. McKinney Products Company.
   c. Select Products Limited.

B. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

C. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

D. Cylinders: Specified in Section 087100 "Door Hardware."

E. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

F. Operating Trim: BHMA A156.6.
1. Design: Match locks specified in Section 08 7100.

G. Pull Handles: As selected by Architect from manufacturer’s full range of models.

H. Push Bars: As selected by Architect from manufacturer’s full range of models.

I. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
1. Manufacturers:
   a. Corbin Russwin Architectural Hardware.
   b. LCN Closers.
   c. Norton Door Controls.
   d. Rixson Specialty Door Controls.

J. Surface-Mounted Holders: BHMA A156.16, Grade 1.

K. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

L. Weather Stripping: Manufacturer's standard replaceable components.
1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

M. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

N. Silencers: BHMA A156.16, Grade 1.

O. Thresholds: BHMA A156.21, raised thresholds beveled with slope of not more than 1:2 and maximum 1/2 inch (12.7 mm) height.

2.6 GLAZING

A. Glazing: Specified in Section 08 8000.

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. 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.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   6. Provide deflection receivers for head mullions where indicated that accommodate deflection of construction above storefront framing.
   7. Each window shall have a permanent label with the manufacturer's logo, city, state and Product Approval Number.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

I. Sheet Metal Trim and Flashing: Fabricate sheet metal per applicable requirements of Section 07 6200. Provide continuous cleats for anchorage.
   1. Brake form in minimum 8 ft lengths.
   2. Hem exposed edges.
   3. Finish exposed surfaces same as storefront framing.
   4. Thickness: As noted, but not less than 0.060 inch except minimum 0.090 inch for pieces with exposed faces more than 2 inches wide.
   5. Provide backing plates for joints in extruded trim that are formed to fit profiles.

J. Extruded Trim: Finish same as storefront framing.
   1. Minimum 8 ft lengths.
   2. Minimum 0.060 inch except minimum 0.090 inch for units with exposed faces more than 4 inches wide.
   3. Sill Extensions: Units with integral slope to shed water and drip edge with sealant receiver.

2.9 ALUMINUM FINISHES

A. Clearr Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adjoining air and vapor seal materials are in place and correctly installed.

3.2 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. General:
1. Do not install damaged components, including items that have deficient finishes.
2. Fit joints to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
5. Apply finish touch-up materials to cut ends before assembly so that no "raw," uncoated aluminum is visible after assembly.
6. Install in accordance with Product Approval documentation.

C. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

D. Anchor fixexd components rigidly and securely to building structure.

E. Set continuous sill members and flashing in continuous sealant beads per requirements of Section 07 9200 to produce weathertight installation.

F. Set thresholds in bed of sealant and fasten rigidly and securely in place so they do not rock or cause noise when walked on.

G. Set components plumb, level, and true to line, and without warp, rack, or other distortion. Install components accurately aligned and accurately located in reference to column lines and floor levels.

H. Coordinate attachment and sealing of perimeter air and vapor barrier materials.

I. Fill perimeter shim spaces and voids within trim with closed cell spray polyurethane foam insulation.

J. Install flashing in longest lengths practicable. Lap joints 6 inches and fill joint with full coating of non-migrating, non-hardening sealant. Secure flashings with concealed fasteners that allow thermal movement without buckling, loosening, loss of watertightness, or other damage.

K. Ensure that weeps and internal drainage systems are in place, unblocked, and fully functional before installing glass.

L. Clean glazing channels of debris, waste, aluminum scraps, and other loose or contaminating materials.

M. Install glazing as specified in Section 08 8000.

N. Install weatherseal sealant according to Section 07 9200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.3 ENTRANCE DOORS

A. Install doors with uniform jamb and head clearance.

B. Adjust operating hardware for smooth, accurate operation and secure closure.

C. Adjust closers per ADA requirements.

D. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

E. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
   c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.
5. Joint Widths: Full contact hairline for permanent connections; maximum 1/32 inch (0.8 mm) for joints at removable glazing stops.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
      a. Perform minimum two tests in areas as directed by Architect.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. Maintenance Tools and Instructions: Provide complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
   2. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior, sliding, power-operated automatic entrances.

B. Related Sections:
   1. Division 26 Sections for electrical connections including conduit and wiring for automatic entrance operators and access-control devices.

1.2 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

C. FBC: Florida Building Code.

D. IBC: International Building Code.

E. Safety Device: Device that, to avoid injury, prevents a door from opening or closing.

F. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design automatic entrances, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
   1. Design Pressures: (windload requirements): Meet the calculated positive and negative design (windload) pressures as indicated on the drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Operating Temperature Range: Provide automatic entrances that operate within minus 20 to plus 122 deg F (minus 29 to plus 50 deg C).

E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. (6.4 L/s x sq. m) of fixed entrance system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

F. Opening-Force Requirements:
   1. Power-Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.
   2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for a breakaway door or panel to open.

G. Entrapment Force Requirements:
   1. Power-Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For automatic entrances. Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. For metal stud exterior wall systems, attachment must be coordinated with exterior stud design. General Contractor shall be responsible for coordination of information.
   3. Wiring Diagrams: For power, signal, and control wiring.
   4. Activation and safety devices.
   5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Delegated-Design Submittal: For automatic entrances indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For Installer, manufacturer, and certified inspector.

G. Product Certificates: For each type of automatic entrance, from manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for automatic entrances.

I. Field quality-control reports.

J. Maintenance Data: For automatic entrances, safety devices, and control systems to include in maintenance manuals.

K. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer with company certificate issued by AAADM.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a certified inspector.
   1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

C. Certified Inspector Qualifications: Certified by AAADM.

D. Source Limitations for Automatic Entrances: Obtain automatic entrances from single source from single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Power-Operated Door Standard: BHMA A156.10.

G. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

H. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to automatic entrances including, but not limited to, the following:
      a. Structural load limitations.
      b. Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
      c. Coordination with electrical, glazing, and other trades.
      d. Required testing, inspecting, and certifying procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks that control automatic entrances. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Templates: Obtain templates for doors, frames, and other work specified to be factory prepared for installing automatic entrances, and distribute to parties involved. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.

C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.

D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Faulty operation of operators, controls, and hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 5 years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of automatic entrance Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
   1. Engage a certified inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
   2. Perform maintenance, including emergency callback service, during normal working hours.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   2. Sheet and Plate: ASTM B 209 (ASTM B 209M).

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

C. Glazing: As specified in Division 08 Section "Glazing."

D. Sealants and Joint Fillers: As specified in Division 07 Section "Joint Sealants."

E. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30-mil(0.76-mm) thickness per coat.

F. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.2 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances including doors, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.
   1. Each component shall have a permanent label with the manufacturer's logo, city, state and Product Approval Number."

B. Single-Sliding Automatic Entrance:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Nabco Entrances, Inc.; System GT1175 or comparable product by one of the following:
      a. Besam Automated Entrance Systems, Inc.; an ASSA ABLOY Group company.
      b. Horton Automatics; Div. of Overhead Door Corporation.
      c. Stanley Access Technologies; Div. of The Stanley Works.
   2. Configuration: Single-sliding door, with one sliding leaf and sidelite.
      a. Traffic Pattern: Two way.
      b. Emergency Breakaway Capability: Sliding leaf only.
      c. Mounting: Between jambs.
   3. Activation Device: Motion detector mounted on each side of door header to detect pedestrians in activating zone and to open door.
   4. Safety Devices: Presence detector mounted on each side of door header to detect pedestrians in presence zone and to prevent door from closing.
   5. Finish: Finish framing, door(s) and header with finish matching adjacent storefront.
      a. Color: As selected by Architect from full range of industry colors and color densities.

2.3 ENTRANCE COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.
   1. Nominal Size: 1-3/4 by 4-1/2 inches (45 by 115 mm).

2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch (1.6-mm) wall thickness.

B. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch (45-mm) thick glazed doors with minimum 0.125-inch (3.2-mm) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
1. Glazing Stops and Gaskets: Square**,** snap-on, extruded-aluminum stops and manufacturer's standard preformed gaskets.
2. Stile Design: Medium stile, 3-1/2-inch (90-mm) nominal width.
3. Rail Design: 5-inch (125-mm) nominal height.

C. Headers: Fabricated from minimum 0.125-inch (3.2-mm) thick, extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
1. Mounting: Concealed, with one side of header flush with framing.
2. Capacity: Capable of supporting doors up to 220 lb (100 kg) per leaf over spans up to 14 feet (4.3 m) without intermediate supports.
a. Provide sag rods for spans exceeding 14 feet (4.3 m).

D. Sliding Door Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
1. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

E. Sliding Door Threshold: Manufacturer's standard threshold members and bottom-guide track system, with stainless-steel, ball-bearing-center roller wheels.

F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

G. Signage: Affixed to both sides of each door as required by BHMA A156.10 for type of door and its operation.
1. Application Process: Door manufacturer's standard process.
2. Provide sign materials with instructions for field application after glazing is installed.

2.4 DOOR OPERATORS AND ACTIVATION AND SAFETY DEVICES

A. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
1. Door Operator Performance: Provide door operators that will open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
2. Electromechanical Operators: Concealed, self-contained overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with

solid-state microprocessor controller; UL 325; and with manual operation with power off.

a. Operator Features:
   1) Power opening and closing.
   2) Adjustable opening and closing speeds.
   3) Adjustable hold-open time between 0 and 30 seconds.
   4) Obstruction recycle.
   5) On-off/hold-open switch to control electric power to operator.

B. Presence Sensors: Self-contained, infrared-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds. Sensors shall remain active at all times.

C. Combination Motion/Presence Sensors: Self-contained units; consisting of both motion and presence sensors in a single metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.
   1. Motion Sensor: K-band-frequency, microwave-scanner units; with relay hold time of not less than 2 to 10 seconds.
      a. Provide capability for switching between bidirectional and unidirectional detection.
      b. For one-way-traffic entrances, sensor on egress side shall not be active when doors are fully closed.
   2. Presence Sensor: Infrared-scanner units; with relay hold time of not less than 2 to 10 seconds. Sensors shall remain active at all times.

D. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.5 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.

B. Breakaway Device for Power-Operated Doors: Provide breakaway device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be 50 lbf (222 N) according to BHMA A156.10. Interrupt powered operation of door operator while in breakaway mode.

C. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn; with minimum 1-inch (25-mm-) long throw bolt; BHMA A156.5, Grade 1.
   1. Cylinders: As specified in Division 08 Section "Door Hardware."
      a. Keying: Integrate into building master key system.
   2. Deadbolts: Laminated-steel hook, mortise type, BHMA A15.6.5, Grade 1.
   3. Three-Point Locking for Sliding Doors: Mechanism in stile of active door leaf that automatically extends second lockbolt into overhead carrier assembly.

D. Weather Stripping: Manufacturer's standard replaceable components.

1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile, with nylon-fabric or aluminum-strip backing.

2.6 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
   1. Form aluminum shapes before finishing.
   2. 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.
   3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
      a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
      b. Reinforce members as required to receive fastener threads.
   4. 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.

B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
   1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
   2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
   3. Form profiles that are sharp, straight, and free of defects or deformations.
   4. Provide components with concealed fasteners and anchor and connection devices.
   5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
   6. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within system to the exterior.
   7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
   8. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
   1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors.

G. Activation and Safety Devices:
   1. General: Factory install devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
   2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:
      a. Top Beam: 48 inches (1219 mm).
      b. Bottom Beam: 24 inches (610 mm).

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Apply anodic finishes to formed metal after fabrication unless otherwise indicated.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
   1. Install in accordance with Product Control Notice of Approval for approved submittal.
   2. 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.
   3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
   1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.

2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
4. Level recesses for recessed thresholds using nonshrink grout.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.

D. Access-Control Devices: Connect access-control devices to access-control system as specified in Division 28 Sections.

E. Activation and Safety Devices: Install and adjust devices to provide detection field and functions indicated.

F. Glazing: Install glazing as specified in Division 08 Section "Glazing."

G. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide weathertight installation.
1. Set thresholds, bottom-guide track system, framing members and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

H. Signage: Apply signage on both sides of each door as required by referenced door standards.

I. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

A. Inspection: Engage Installer's certified inspector to test and inspect automatic entrances and prepare test and inspection reports.
1. Certified inspector shall test and inspect each automatic entrance to determine compliance of installed systems with applicable BHMA standards.
2. Inspection Report: Certified inspector shall submit report in writing to Architect and Contractor within 24 hours after inspection.

B. Work will be considered defective if it does not pass tests and inspections.

3.4 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation and for weathertight closure; comply with requirements in BHMA A156.10.

B. Lubricate operating hardware and other moving parts as recommended by manufacturer.

C. Readjust door operators and controls after repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 CLEANING AND PROTECTION

A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
   1. Comply with requirements in Division 08 Section "Glazing" for cleaning and maintaining glass.

3.6 DEMONSTRATION

A. Engage a certified inspector to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes all-glass entrance doors and supplementary items required for installation of the following types of doors:
   1. Interior doors.
   2. Transoms.

B. Related Sections include the following:
   1. Section 07 9200 “Joint Sealants” at interface of all-glass entrances and other building components.
   2. Section 087100 “Door Hardware” for lock cylinders installed in all-glass entrance locksets.

1.2 SUBMITTALS – in accordance with instructions contained in Section 01330

A. Product Data: For each type of product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Show details of fabrication and installation, including the following:
   1. Plans, elevations and sections. Including layout and relationship to adjacent work.
   2. Details of rail sections and fittings.
   3. Hardware quantities, locations, and installation requirements.
   4. Anchorages and reinforcement.
   5. Glazing details.

C. Samples for Verification: Of size indicated below and of same thickness and material indicated for Work. Show the full range of color and texture variations expected.
   1. Aluminum extrusions: 6-inch – (150-mm-) long sections of rails and other items.
   2. Glass: Sample nominally 12” x 12” of color and thickness desired showing exposed-edge finish.

D. Hardware Schedule:
   1. Submit hardware schedule for each door opening.
   2. Include catalog cuts if not shown on shop drawings.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing all-glass entrances similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type of all-glass entrance through one source from a single manufacturer.

C. Regulatory Requirements: Conform to applicable requirements of code authorities having jurisdiction over project. Confirmation of ADA requirements must be verified with appropriate building officials.

D. Reference Standards:
1. ANSI Z97.1 Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Tests.
2. ASTM C 1036 Specification for Flat Glass
3. ASTM C 1048 Specification for Heat-Treated Flat Glass – Kind FT
4. CPSC 16 CFR 1201 Architectural Glazing Standards and Related Materials.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify opening dimensions of all-glass entrances by field measurements before fabrication and indicate the measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating all-glass entrances without field measurements. Coordinate construction to ensure actual opening dimensions correspond to established dimensions.

1.5 WARRANTY

A. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of all-glass entrances that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
1. Structural failures.
2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
3. Failure of operating components to function normally.

B. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All-Glass Entrance Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Oldcastle Glass
2. Craftsman Tempered Glass
3. J.E. Berkowitz, LP
4. ACI Glass Products.
5. Blumcraft of Pittsburgh.
6. Virginia Glass Products Corp.

B. Door Hardware Manufacturer: Details shown are based on DORMA Manet Compact Sliding Door System manufactured and distributed by DORMA Glas, 1520 Jabez Run Suite 303, Millersville, MD 21108 Phone 301.390.1000 Fax 301.390.0011 Internet: www.dorma.com/usa

2.2 MATERIALS

A. Clear Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Class 1 (clear) requirements. Provide products of thickness indicated that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to CPSC 16 CFR, part 1201 for Category II materials.
   1. Thickness: (12 mm) ½"
   2. Exposed Edges: Flat polished.
   3. Butt Edges: Flat ground.
   4. Corner Edges: Mitered.

B. Stainless-Steel hardware: Type 316.

2.3 COMPONENTS

A. Provide DORMA Compact Sliding Doors and Entrance configurations shown on architectural drawings, unless otherwise indicated, and as follows:
   1. Material: Type 316 Stainless-steel
   2. Full width tubular stainless track rod 25 mm diameter with single-point fixing (counter-sunk) for track fixing to glass – 1-1/16", Art No. 29.518, as shown on the architectural drawings.
   3. The screw attaching the pivoting hardware to the glass shall be a 32 mm diameter countersunk as shown on architectural drawings.
   4. Maximum door weight is 100 kg (220 lb).
   5. Maximum door height is 3000 mm (118").
   6. Maximum door width is 1200 mm (48")
   7. Vertical (height) adjustment is + or – 2.5 mm for the carrier assembly.
   8. Horizontal mounting adjustment is + or – 5 mm for glass or wall attachment.
   9. Anti-jump device is recommended at the end of travel stops.

B. Push-Pull Set: DORMA Glas Locking Ladder Pull

C. Single-Door Locksets: Manufacturer's standard patch dead-bolt locksets and as follows:
   1. Location and Function: Locking Ladder Pull with deadbolt (49"). Dead bolt operated by key outside and thumb-turn inside and engaging a dust proof strike.
   2. Cylinders: As specified in Section 08 7100 "Door Hardware."

2.4 TRANSOMS

A. Glass: 1/2 inch clear tempered with flat polished edges.

B. Transoms are captured by U-channels or glass connectors as shown on drawings. Attachment of pivot rod to transom shall be direct or with an angle plate attaching to both transom and sidelight as shown on architectural drawings. Caution: walls or transoms supporting the door must be designed to sustain the weight of the door and its components.

   1. Hardware Basis of Design: DORMA Standard Mechanical Channel for 1/2 inch glass thickness; Base profile standard type (Art. No. 807.045) and Clamping part standard type (Art. No. 807.085)

C. General: Fabricate all-glass entrance components in sizes, profiles, and configurations shown on the architectural drawings.
   1. Provide holes and cutouts in glass to receive hardware, fittings, and accessories prior to tempering glass. Do not cut, drill, or make other alterations to glass after tempering. Hole to hole distance dimensions are very critical when using counter sunk screws. Glass drilling tolerance of + or - .3 mm is recommended.
   2. Fully temper glass using horizontal roller hearth process.
   3. Tighten the single point fixing bolts with a Manet Assembling tool with a torque wrench to 15Nm (11 ft-lb)

2.5 STAINLESS STEEL FINISHES

A. Remove or blend tool and die marks and stretch lines into finish.

B. Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

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 all-glass entrances. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install all-glass entrances and associated components according to manufacturer's written instructions.

B. Set units level and plumb.

C. Maintain uniform clearances between adjacent components.

D. Lubricate hardware and other moving parts according to manufacturers written instructions.

E. Set, seal, and grout floor closer cases as required by hardware and substrate.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide smooth operation.

B. Remove excess sealant and glazing compounds and dirt from all-glass entrance surfaces.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure all-glass entrances are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following:
      a. Swinging doors.
      b. Other doors to the extent indicated.
   2. Cylinders for doors specified in other Sections.

B. Related Sections include the following:
   1. Division 08 Section "Hollow Metal Doors and Frames" for astragals provided as part of fire-rated labeled assemblies and for door silencers provided as part of hollow-metal frames.
   2. Division 08 Section "Flush Wood Doors" for astragals and integral intumescent seals provided as part of fire-rated labeled assemblies.
   3. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, except cylinders.
   4. Division 08 Section "Sliding Automatic Entrances" for entrance door hardware, except cylinders.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
   1. Cylinders for locks specified in other Sections.

1.3 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

C. Warranty: Special warranty specified in this Section.

D. Other Action Submittals:
   1. Door Hardware Sets: In DHI format, prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.

b. Content: Include the following information:
   1) Identification number, location, hand, and material of each door and frame.
   2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
   3) Complete designations of every item required for each door or opening including name and manufacturer.
   4) Fastenings and other pertinent information.
   5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   6) Explanation of abbreviations, symbols, and codes contained in schedule.
   7) Mounting locations for door hardware.
   8) Door and frame sizes and materials.
   9) List of related door devices specified in other Sections for each door and frame.

c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of factory-trained workers and approved by lock manufacturer.
   1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   2. Installer shall have warehousing facilities in Project's vicinity.
   3. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated..

C. Preinstallation Conference for Mechanical Hardware: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to mechanical door hardware, including but not limited to, the following:
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of operators and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion, except as follows:
      a. Cylindrical Locks: Five years from date of Substantial Competition.
      b. Exit Devices: Two years from date of Substantial Completion.
      c. Manual Closers: Ten years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
   2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
   3. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).

B. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   1.

		Metal Thickness (inches)	
Maximum Door Size (inches)	Hinge Height (inches)	Standard Weight	Heavy Weight
36 by 84 by 1-3/4	4-1/2	0.134	0.180
42 by 90 by 1-3/4	5	----	0.190

C. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Exterior Hinges: Stainless steel, with stainless-steel pin non-removable.
   2. Interior Hinges: Steel, with steel pin

E. Fasteners: Comply with the following:
   1. Use only fasteners supplied by hardware manufacturer.
   2. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
   3. Wood Screws: For wood doors.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1.

B. Template Hinge Dimensions: BHMA A156.7.

C. Manufacturers:
   1. Hager Companies (HA).
   2. McKinney Products Company; an ASSA ABLOY Group company (MK).
   3. Stanley Commercial Hardware; Div. of The Stanley Works (ST).

2.4 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Lock Trim:
   1. Levers: Cast.
   2. Provide knurled levers for all openings into hazardous areas, including but not limited to electrical and mechanical rooms, janitors closets, and elevator machine rooms, whether listed in hardware sets or not.
   3. Escutcheons (Roses): Wrought.
      a. Where lead-lined latches are indicated, provide lead-lined escutcheons.
   4. Dummy Trim: Match lever lock trim and escutcheons.
   5. Locksets to be one of the following:
      a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR) ML2000 Series
      b. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SA). 8200 Series
      c. Schlage Lock Co., an Ingersoll Rand Company (SC) L9000 Series
      d. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YA) 8800 Series

2.5 DOOR BOLTS

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Surface Bolts: Minimum 1-inch (25-mm) throw.
   2. Mortise Flush Bolts: Minimum 3/4-inch (19-mm) throw.

B. Dustproof Strikes: BHMA A156.16, Grade 1.

C. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.
   1. Manufacturers:

a. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
b. Hager Companies (HA).
c. IVES Hardware; an Ingersoll-Rand Company (IV).
d. Rockwood Manufacturing Company (RO).
e. Trimco (TB).

D. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1; designed for mortising into door edge.
1. Manufacturers:
a. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
b. Hager Companies (HA).
c. IVES Hardware; an Ingersoll-Rand Company (IV).
d. Rockwood Manufacturing Company (RM).
e. Trimco (TBM).

2.6 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1.

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Outside Trim: Material and finish to match locksets, unless otherwise indicated.
1. Match design for locksets and latchsets, unless otherwise indicated.

F. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors, and fire-rated wood doors.

G. Exit Devices to be one of the following:
a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR) ED5000 Series
b. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SA). 80 Series
c. Von Duprin, an Ingersoll Rand Company (VD) 98 Series
d. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YA) 7000 Series

2.7 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1 unless Grade 2 is indicated.

B. Cylinders: Manufacturer's standard interchangeable type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
   1. Factory keyed.
   2. Number of Pins: Six.
   3. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
   4. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   5. Bored-Lock (Cylindrical-Lock) Type: Cylinders with tailpieces to suit locks.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
      a. Replace construction cores with permanent cores, as directed by Owner.

E. Manufacturers:
   1. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
   2. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SA).
   3. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SC).
   4. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YA).

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

B. Keys: Nickel silver.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE."
   2. Quantity: In addition to one extra key blank for each lock, provide the following:
      a. Cylinder Change Keys: Four.
      b. Master Keys: Six.

2.9 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5, Grade 1; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
   1. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

2.10 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from aluminum, unless otherwise indicated.

C. Manufacturers:
1. Hager Companies (HA).
2. IVES Hardware; an Ingersoll-Rand Company (IV).
3. Rockwood Manufacturing Company (RO).
4. Trimco (TB).

D. Push-Pull Plates: Metal 0.050 inch minimum thickness.

2.11 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Comply with the following maximum opening-force requirements:
   a. Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.

B. Surface Closers: BHMA A156.4, Grade 1 unless Grade 2 is indicated. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
1. Manufacturers:
   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR) DC6000 Series
   b. LCN Closers; an Ingersoll-Rand Company (LN). 4040 Series
   c. Norton Door Controls; an ASSA ABLOY Group company (NO). 7500 Series
   d. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SA). 351 Series
   e. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YA) 4400 Series

C. Coordinators: BHMA A156.3.
1. Manufacturers:
   a. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
   b. Rockwood Mfg. Co. (RO)
   c. Ives: H. B. Ives (IV).
   d. McKinney Products Co. (MK).

2.12 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16, Grade 1 unless Grade 2 is indicated. Provide wall-mounted stops unless physically impractical.

B. Mechanical Door Holders: BHMA A156.16, Grade 1 unless Grade 2 is indicated.

C. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1 unless Grade 2 is indicated.

D. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

E. Manufacturers:
1. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
2. Hager Companies (HA).
3. IVES Hardware; an Ingersoll-Rand Company (IV).
4. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RX).
5. Rockwood Manufacturing Company (RO).
6. Trimco (TB).

2.13 DOOR GASKETING

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Manufacturers:
1. Pemko Manufacturing Co. (PE).
2. Reese Enterprises (RE).
3. Zero International (ZR).

2.14 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

D. Manufacturers:
1. Pemko Manufacturing Co. (PE).
2. Reese Enterprises (RE).
3. Zero International (ZR).

2.15 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
      a. Surface hinges to doors.
      b. Closers to doors and frames.
      c. Surface-mounted exit devices.
   3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
   4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.16 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
   3. Coordinate mounting of panic/exit devices with light opening so that hardware does not cross window.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
   3. Use only fasteners supplied by manufacturer.
   4. Do not install exit devices across door window lites.

C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Thresholds: Set thresholds for exterior doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
   1. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hairline joints; join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.
   2. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel which will not corrode in contact with the threshold metal.
   3. At exterior doors set thresholds in a bed of either butyl rubber sealant or polyisobutylene mastic sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant.

3.3 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended.
   1. Adjust door control devices after start-up of operation of heating and ventilating equipment; comply with referenced accessibility requirements.
   2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3

seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

a. Adjust all closers to open 90 degrees minimum.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.4 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.5 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

b. Hardware listed from the following manufacturers:

AR	Adams Rite
CR	Corbin Russwin
MK	McKinney
PE	Pemko
RO	Rockwood
RX	Rixson
LO	Lockwood

HARDWARE SCHEDULE

HW-1
Doors: 102a – 102b
Each to have:

1	Cylinder	1000 Series as required		626	CR
1	I C Core	8000 series as required		626	CR

Note: Balance of hardware by door mfg

HW-2
Doors: 142b
Each to have:

1 set	Pivots	147		626	RX
1	Int Pivot	M19		626	RX
1	Deadbolt	MS1890-1 ½		626	AR
1	Cylinder	1000 – A03 as required		626	CR
1	I C Core	8000 Series as required		626	CR
1	Thumbturn	1013 – A03 as required		626	CR
1 set	Push Bar / Pull	BF15847		630	RO
1	Closer	DC6210 – A4 x brackets as required		689	CR
1	Threshold	By Door Mfg.			
1	Weatherstrip	By Door Mfg.			

HW-3
Doors: 158
Each to have:

3	Hinges	T4A3386-NRP		630	MK
1	Rim Exit Device	ED5200S x PR955 M107 M110		630	CR
1	Cylinder	3000 Series as required		626	CR
1	I C Core	8000 Series as required		626	CR
1	Closer/Stop	DC6210 – A4		689	CR
1	Kick Plate	K1050	8” x 2” LDW	630	RO
1	Threshold	2005AS	LAR	AL	PE
1	Weatherstrip	296CS	LAR	AL	PE
1	Door Bottom	216AV	LAR	AL	PE
1	Rain Guard	347 x 68AR	Door Width + 4”	AL	PE

HW-4
Doors: 100a
Each to have:

3	Hinges	T4A3786		652	MK
1	Entry Lock	ML2051	PSA	626	CR
1	I C Core	8000 series as req		626	CR
1	D A Closer	DC6210 – M71		689	CR
1	Kick Plate	K1050	8” x 2” LDW	630	CR
1	OH Stop	OH 1000 Series		630	RO
3	Silencers				

HW-5
Doors: 142 – 151
Each to have:

3	Hinges	TA2714		652	MK
1	Passage Latch	ML2010	PSA	626	CR
1	H O Closer	DC6200 – A1		689	CR
1	Kick Plate	K1050	8” x 2: LDW	630	CR
1	Wall Stop	400 Series		630	CR
3	Silencers				

HW-6
Doors: 104 – 105
Each to have:

3	Hinges	TA2714		652	MK
1	Privacy Lock w/Ind.	ML2030 – M19SN	PSA	626	CR
1	D A Closer	DC6200 – M71		689	CR
1	Kick Plate	K1050	8” x 2” LDW	630	RO
1	Mop Plate	K1050	4” x 1” LDW	630	RO
1	Wall Stop	400 Series		630	RO
3	Silencer				

HW-7
Doors: 130 – 131 – 133 – 134 – 143 – 145 – 147 – 155
Each to have:

3	Hinges	TA2714		652	MK
1	Passage Latch	ML2010	PSA	626	CR
1	Wall Stop	400 Series		630	RO
3	Silencers				

HW-8
Doors: 112 – 113 – 114 – 116 – 117 – 144 – 150
Each to have:

3	Hinges	TA2714		652	MK
1	Privacy Lock w/ Ind	ML2030 – M19SN	PSA	626	CR
1	Kick Plate	K1050	8" x 2" LDW	630	RO
1	Mop Plate	K1050	4" x 1" LDW	630	RO
1	Wall Stop	400 Series		630	RO
3	Silencers				

HW-9
Doors: 197 – 109a – 109b – 111
Each to have:

3	Hinges	TA2714		652	MK
1	Classroom Lock	ML2055	PSA	626	CR
1	Wall Stop	400 Series		630	CR
3	Silencers				

HW-10
Doors: 139 – 110b
Each to have:

3	Hinges	TA2714		652	MK
1	Storeroom Lock	ML2057	PSA	626	CR
1	O H Stop	OH1000 Series		630	RO
3	Silencers				

HW-11
Doors: 125 – 126 – 103b – 107 – 107b – 118 – 140 - 149
Each to have:

3	Hinges	TA2714		652	MK
1	Storeroom Lock	ML2057	PSA	626	CR
1	Wall Stop	400 Series		630	RO
3	Silencers				

HW-12
Doors: 103 – 121 – 122 – 123 – 124 – 127 – 135 – 136 – 138 – 153 – 154
Each to have:

3	Hinges	TA2714		652	MK
1	Office Lock	ML2065	PSA	626	CR
1	Wall Stop	400 Series		630	RO
3	Silencers				

HW-13
Doors: 109 - 157
Each to have:

6	Hinges	T4A3386-NRP		630	MK
1	Rim Exit Device	ED5200S x PR955 M107 M110		630	CR
1	Cylinder	3000 Series as required		626	CR
1	I C Core	8000 Series as required		626	CR
1	Closer/Stop	DC6210 – A4		689	CR
2	Flush Bolts	556 WS		626	RO
2	Kick Plate	K1050	8" x 2" LDW	630	RO
1	Threshold	2005AS	LAR	AL	PE
1	Weatherstrip	296CS	LAR	AL	PE
2	Door Bottom	216AV	LAR	AL	PE
1	Rain Guard	347 x 68AR	Door Width + 4"	AL	PE

HW-14
Doors: 108- 109c – 128 – 146 – 146b – 146c
Each to have:

Complete hardware by door mfg.

HW-15
Doors: 106 – 128 (LEAD LINED DOORS / FRAMES)
Each to have:

1	Pivot Set	L147		626	RX
1	Intermediate Pivot	ML19		626	RX
1	Passage Latch	ML2010 ***(DOOR 106 ONLY)*** PSA		626	CR
1	Classroom Lock	ML2055 ***(DOOR 128 ONLY)*** PSA		626	CR
1	Stop	FS02		626	LO
1	Armor Plate	K1050	36" x 2" LDW	630	RO
1	Mop Plate	K1050	4" x 1" LDW	630	RO

(ARMOR PLATE AND MOP PLATE AT DOOR 128 ONLY)

HW-16
Doors: 109d
Each to have:

6	Hinges	TA2714		652	MK
1	Storeroom Lock	ML2057	PSA	626	CR
2	O H Stop	OH1000 Series		630	RO
1	Flush bolt	2905		626	RO

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows.
   2. Doors.
   3. Glazed curtain walls.
   4. Storefront framing.
   5. Glazed entrances.
   6. Interior borrowed lites.

B. Related Sections:
   1. Division 08 Section "Automatic Entrances."
   2. Division 08 Section "Structural-Sealant-Glazed Curtain Walls" for glazing sealants.
   3. Division 13 Section “Radiation Protection” for lead lined glass.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.3 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each glass product and glazing material indicated.

C. Glass Samples: For each type of the following products; 12 inches (300 mm) square.
   1. Tinted glass.
   2. Coated glass.

3. Insulating glass.
4. Glazing Accessory Samples: For gaskets and sealants, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
5. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass and glazing products, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Manufacturer warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Source Limitations for Glass: Obtain laminated glass and insulating glass from single source from single manufacturer for each glass type.

D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA "Laminated Glazing Reference Manual" and GANA "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

H. Mockup: Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTIES

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separa-

tion, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Heat-Strengthened Glass: Kind HS.
2. Tempered Glass: Kind FT.
3. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
4. For uncoated glass, comply with requirements for Condition A.
5. For coated vision glass, comply with requirements for Condition C (other coated glass).
6. Maximum peak to valley rollerwave 0.005 inch (0.08mm) in the central area and 0.008 inch (0.20mm) within 10.5 inches of leading and trailing edges.
7. Maximum bow and warp 1/32 inch per lineal foot

C. Reflective-Coated Vision Glass: ASTM C 1376, coated by vacuum deposition (sputter-coating) process, and complying with other requirements specified.

D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

E. Reflective-Coated Spandrel Glass: ASTM C 1376, Kind CS; coated by vacuum deposition (sputter-coating) process, and complying with other requirements specified.

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
   1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary.
   2. Spacer: Manufacturer's standard spacer material and construction.
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. EPDM complying with ASTM C 864.
   2. Silicone complying with ASTM C 1115.
   3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.6 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
   4. Color of Exposed Glazing Sealants: Standard color selected by Architect from manufacturer's full range.
   5. Color of Exposed Glazing Sealants: Translucent clear.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 SLIDING GLASS WINDOW TRACK ASSEMBLIES:

A. Manufacturers: Subject to compliance with requirements, provide products by CR Laurence (CRL 48" Double Track Ball Bearing Package Assembly (used with 1/4" glass) - KV99248.
   1. Finish: Clear, anodized aluminum.
   2. Lock: CRL sliding glass door lock 2040
   3. Pull: CRL, satin anodized extended aluminum for showcase finger pull with 1 inch lip D6394A.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.11 MONOLITHIC-GLASS TYPES

A. Glass Type #1: Clear fully tempered float glass.
   1. Thickness: 3/8 inch.
   2. Provide safety glazing labeling.

2.12 INSULATING-GLASS TYPES

A. Glass Type #2: Low-e-coated, tinted insulating glass.
   1. Overall Unit Thickness: 1 inch (25 mm).
   2. Thickness of Each Glass Lite: 6.0 mm (1/4 inch).
   3. Outdoor Lite: Tinted heat-strengthened float glass.
   4. Interspace Content: Air.
   5. Indoor Lite: Clear heat-strengthened float glass or fully tempered float glass.
   6. Visible Light Transmittance: 37 percent minimum.
   7. Shading Coefficient: 0.36 minimum.
   8. Summer Daytime U-Factor: 0.29 maximum.
   9. Solar Heat Gain Coefficient: 0.31 maximum.
   10. Provide safety glazing labeling.

B. Glass Type #3: Ceramic coated spandrel glass tinted, heat strengthened float glass.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Viracon standard spandrel glass panel or comparable product.
   2. Thickness: 1/4 inch.

3. Tint Color: 1/ 4 inch Solar Blue over 1/2 inch air space over 1/4 inch high opacity white spandrel glass.
4. Coating Location: Second surface.
5. Winter Nighttime U-Factor: 0.47.
6. Summer Daytime U-Factor: 0.49.
7. Fallout Resistance: Passes fallout resistance test in ASTM C1048 for assembly of glass and adhered reinforcing material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and off-sets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with applicable requirements of Section 01 7300.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

D. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by pre-construction testing.

F. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

H. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

I. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

K. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 GASKET GLAZING (DRY)

A. Comply with manufacturer recommendations of framing system.

B. Where indicated by manufacturer, seal corners watertight.

C. Install gaskets in single pieces on each side of opening with joints only at corners.

D. Compress gaskets to produce weathertight seal without developing bending stresses in glass.

E. Where recommended by framing system manufacturer, seal gasket joints.

F. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against interior gasket. Install exterior gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress exterior gaskets to produce weathertight seal without developing bending stresses in glass.

G. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

3.5 TAPE GLAZING

A. Install tape on fixed stop form continuous airtight seals. Do not stretch tapes to make them fit.

B. Butt tape corners, do not lap. Seal joints as recommended by tape manufacturer for performance requirements.

C. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

D. Apply heel bead of elastomeric sealant.

E. Insert spacer shims between glass and removable stops at 24 inch intervals, but not less than 2 per side, and 1/4 inch below sight line.

F. Fill gaps between pane and stops with paintable calk and tool to smooth surface flush with sight line.

3.6 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:
   1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

C. Drawing Convention: Runner track, studs, bracing, bridging, and concealed supports shown on Drawings are intended as diagrammatic to indicate supports for exposed elements, and shall not limit Contractor with respect to use of standard framing methods recommended by the manufacturer of framing systems or by the Steel Stud Manufacturers Association, including the use of special proprietary components.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of product indicated, including deflection tables indicating compliance with requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

B. Structural Performance: Provide gypsum board assemblies capable of meeting the deflection limits specified in "Framing Systems" article for maximum heights of partitions without failing. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to distort and gypsum board to crack.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   2. Protective Coating: ASTM A 653/A 653M, G40 (Z120) , hot-dip galvanized.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:
   a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
   b. Depth: As indicated on Drawings.
   c. Deflection Limit: L/240.
2. Dimpled Steel Studs and Runners:
   a. Minimum Base-Metal Thickness: 0.025 inch (0.64 mm).
   b. Depth: As indicated on Drawings.
   c. Deflection Limit: L/240.

C. Slip-Type Head Joints: Where indicated, provide the following:
1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.054 inch (1.37 mm).

E. Proprietary Flexible Track: Track manufactured to bend to created curved partitions.
1. Product: Subject to compliance with requirements provide the following:
   a. Flex-Ability Concepts; Flex-C Trac.

F. Proprietary Head/Sill Framing System: Manufactured head and sill components provided by the steel framing system manufacturer may be used instead of individual components shown on Drawings.

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
2. Depth: 7/8 inch (22.2 mm).

I. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Hat shaped.

J. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 1-1/2 inch (38 mm).
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:
1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 1-1/2 inches (38 mm).

E. Furring Channels (Furring Members):
1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm) or 0.033 inch (0.84 mm).

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Grid System.
c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:
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 (3.2 mm) 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 of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Verify that installation of metal stud walls and partitions is coordinated with locations and sizes of plumbing clean-outs and similar piping, fire extinguisher and electrical panels, and other built-in items occurring within the wall.
   1. Depth of stud wall shall be adequate to completely enclose piping and cabinets and to maintain integrity of rated installations.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, fold-down shower seats, wall guards, handrails, wall mounted door stops, furnishings, monitors, or similar construction.
   1. Provide horizontal metal bracing as indicated in details, or as required to provide secure attachment.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: Maximum 16 inches (406 mm) or 24 inches o.c. unless otherwise indicated. See partitions types.
   2. Multilayer Application: Maximum 16 inches (406 mm) or 24 inches o.c. unless otherwise indicated.
   3. Tile Backing Panels: Maximum 16 inches (406 mm) o.c. unless otherwise indicated.
   4. Lead-lined Gypsum Board: Maximum 16 inches (406mm) o.c.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. For walls up to 15 feet in height using 0.0179-inch thick (25 gage) studs, install cold-rolled channel stiffeners at mid-points and attach with 3/8-inch pan head Type S screws driven through both flanges of stud and runner.
2. For walls over 15 feet high install stiffeners at third points and attach with 3/8-inch pan head Type S screws.
3. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
4. Fasten studs to both sides of bottom and top runners.
5. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs, minimum 0.0312-inch (20 gage) bare steel thickness, at each jamb, unless otherwise indicated.
   b. Install steel reinforcing as detailed for lead-lined door frames.
6. Door Openings Over 4'-0" Wide and For Lead-Lined Doors and Frames: Frame opening header with double studs on edge and screwed together, cut to fit snugly between vertical jambs inside runner. Install additional runner and cripple studs as required above header.
7. Contractor Option: Framing manufacturer's proprietary header and sill fabrications may be used instead of individual components shown on Drawings.
   a. Install cripple studs at head adjacent to each jamb stud, with minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
   b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
8. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
9. Openings up to 4'-0" wide: Frame the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
10. Openings over 4'-0": Frame opening header with double studs on edge and screwed together, cut to fit snugly between vertical jambs inside runner. Install additional runner and cripple studs as required above header.
11. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
12. Curved Partitions:
    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.
13. Grab Bars:
14. Install 0.0528 inch thick (16 gage) studs at 8 inches o.c. for full length of grab bar or shower seat plus 16 inches beyond each end.

15. At Wall-Hung Cabinets and/or Casework:
    a. Install 0.0270-inch thick (22 gage) studs at 16 inches o.c. for full width of cabinetwork plus 12 inches beyond on each side of cabinetwork.
16. For Furr-Downs at Wall-Hung Cabinets and/or Casework, for Ducts and Pipes:
    a. Install 0.0179-inch thick (25 gage) studs, 16 inches o.c. before installation of ceiling grid so that grid angle will abut vertical portion of furr-down.
        1) Use braced system for depths of 48 inches and over (vertically) and widths 72 inches and over.
        2) Use unbraced system for furr-downs up to 24 inches by 24 inches.
17. For Control Joints:
    a. Install double studs back-to-back to create control joints.
    b. Space control joints 30 feet apart maximum.
    c. See details for dimension and materials between studs.
18. Bracing of Walls Above Ceilings:
    a. Where studs extend above ceilings, but not to structure, brace top with diagonal stud braces at approximately 36 inches o.c.
    b. Attach stud braces to galvanized steel angles secured to bottom side of structure.
    c. Install diagonal bracing at latch side of all door jambs.
19. Stud Framing at Cementitious Backer Units:
    a. Use 30-mil (~20 gage) studs at maximum spacing recommended by tile backer board manufacturer and to limit deflection to 1/360 for tile, 1/480 for stone.
20. Hat-Shaped Furring Channels on Walls:
    a. Space 16 inches o.c. vertically or horizontally.
    b. For horizontal application install first channels 4 inches from floor and ceiling lines.
    c. Attach to substrate with suitable fasteners spaces 16 inches o.c. in alternate flanges.
    d. Install asphalt felt isolation strip between furring channel and exterior wall surfaces.
21. Single-Span Fixed Ceiling Framing:
    a. Stud framed ceilings may be installed at interior spaces not wider that 8 feet. At spans greater than 8 feet install suspended ceiling.
    b. Install runner channels or steel angles around perimeter.
    c. Space main framing members at 16 inches o.c. with cross bracing at 48 inches o.c.

E. Direct Furring:
    1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
    1. Hangers: 48 inches (1219 mm) o.c.
    2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.

3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.
4. Where light fixtures occur, provide hanger wires at each corner and intermediates as necessary, anchored to structure to carry weight of light fixture. Frame around openings and install additional cross-reinforcing to restore lateral stability of ceiling framing. Light fixtures shall be independent of ceiling framing.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
1. Where light fixtures occur, provide hanger wires at each corner and intermediates as necessary, anchored to structure to carry weight of light fixture. Frame around openings and install additional cross-reinforcing to restore lateral stability of ceiling framing. Light fixtures shall be independent of ceiling framing.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 FIELD QUALITY CONTROL

A. Periodic special inspection shall be provided by the special inspector, coordinated by the Contractor, during construction of non-load bearing walls per the requirements specified in Division 01 Specification "Structural Tests and Inspections".

3.6 CLEANING

A. Remove trash, waste materials, and other debris from framing spaces.

B. Remove residues from beverages and other liquids.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior portland cement plasterwork (stucco) on metal lath unit masonry and monolithic concrete.

B. Related Sections:
   1. Division 05 Section "Cold-Formed Metal Framing" for structural, load-bearing (transverse and axial) steel studs and joists that support lath and portland cement plaster.
   2. Division 06 Section "Gypsum Sheathing" for sheathing and water-resistant barriers included in portland cement plaster assemblies.
   3. Division 07 Section "Weather Barriers" for water-resistant barriers included in Portland cement plaster assemblies.
   4. Division 07 Section "Thermal Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.
   5. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support lath and portland cement plaster (stucco).

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance:
   1. Provide Portland cement plaster assemblies capable of meeting the deflection limits for maximum heights of partitions without failing. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to distort and plaster to crack.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Mockup: Before plastering, install mockup of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. 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.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:
1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
   b. CEMCO.
   c. CLARKWESTERN Building Systems.
   d. Dietrich Metal Framing; a Worthington Industries company.
   e. Marino\WARE.
   f. Phillips Manufacturing Co.
2. Recycled Content: Post consumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.
3. Diamond-Mesh Lath: Self-furring.
4. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).

B. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper.
1. Provide paper-backed lath unless otherwise indicated.

2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
   b. CEMCO.
   c. CLARKWESTERN Building Systems.
   d. Dietrich Metal Framing; a Worthington Industries company.

e. Marino\WARE.
f. Phillips Manufacturing Co.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
4. Cornerbeads: Fabricated from zinc.
   a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
   b. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
5. Casing Beads: Fabricated from zinc; square-edged style; with expanded flanges.
6. Control Joints: Fabricated from zinc; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Expansion Joints: Fabricated from zinc; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.
1. Required for exterior applications.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of not fewer than three exposed threads.

E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

2.4 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.
1. Color for Finish Coats: Gray.

B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

C. Sand Aggregate: ASTM C 897.

D. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. California Stucco Products Corp.; Conventional Portland Cement Stucco.
   b. Florida Stucco; Florida Stucco.
   c. SonoWall, BASF Wall Systems, Inc.; Thoro Stucco.

d. USG Corporation; Oriental Exterior Finish Stucco.

2. Color: As selected by Architect.

2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.

b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters, comply with manufacturer's written instructions.

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 of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster bases that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLING METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C 1063.

1. On Solid Surfaces, Not Otherwise Furred: Install self-furring diamond-mesh lath.

3.4 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Embed all accessory ends, angles, butts and intersections in sealant.

C. Reinforcement for External Corners:
1. Install cornerbead at exterior locations.
2. Wire-tie to metal lath.

D. Control Joints: Install control joints at locations indicated on Drawings or if not indicated in locations approved by Architect for visual effect as follows:
1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
   a. Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
   b. Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.5 PLASTER APPLICATION

A. General: Comply with ASTM C 926.
1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on unit masonry and concrete plaster bases.

C. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 3/4-inch (19-mm) thickness.
1. Portland cement mixes.

D. Plaster Finish Coats: Apply to provide float finish to match Architect's sample.

3.6 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior gypsum board.
2. Sound attenuation blankets.
3. Tile backing panels.

B. Related Requirements:
1. Division 06 Section "Gypsum Sheathing" for gypsum sheathing for exterior walls.
2. Division 06 Section "Solid Mineral Profile Paneling" for monolithic sculptured interior decorative wall surface.
3. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
4. Division 09 Section “Ceramic Tile” for cementitious and fiber-cement tile backing panels.
5. Division 13 Section "Radiation Protection" for lead-lined gypsum board panels.

1.2 DEFINITIONS

A. Wet Area: Where surfaces are soaked, saturated, or regularly and frequently subjected to moisture or liquids, usually water.

B. Limited Water Exposure Area: Where surfaces are subjected to moisture or liquids but do not become soaked or saturated due to system design or time exposure.

1.3 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
1. Each type of gypsum board.
2. Trim accessories.
3. Sound attenuation blankets.

C. Samples: For the following products:
1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory other than edge beads and control joints.

1.4 QUALITY ASSURANCE

A. Finisher: Minimum three years experience in finishing seams of profile paneling.

B. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish and each type of gypsum board (paper-faced and glass-mat-faced) indicated for use in exposed locations.
      b. Each texture finish indicated.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Store materials inside under cover and keep them dry and protected against weather, humidity, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations or the following, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed, watertight, and comply with Environmental Limitations paragraphs.

C. Maintain temperature between 50 degrees Fahrenheit (28 degrees Celsius) minimum and 95 degrees Fahrenheit (53 degrees Celsius) maximum for 48 hours before gypsum board panel and joint treatment installation and continuously during and after installation.

D. Maintain humidity below 60 percent for 48 hours before gypsum board panel and joint treatment installation and continuously during and after installation.

E. Do not install panels that are wet, those that are moisture damaged, or those that are mold/mildew 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/mildew damaged include, but are not limited to, fuzzy or splotchy surface contamination or discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site.

B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. Temple-Inland.
7. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch (15.9 mm), unless noted otherwise.
2. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch (15.9 mm), unless noted otherwise.
2. Long Edges: Tapered.

D. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
1. Thickness: 1/4 inch (6.4 mm).
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 SPECIALTY GYPSUM BOARD

A. Paperless Glass-Mat Interior Gypsum Board: ASTM C1396 and ASTM C1658. With fiber-glass mat laminated to both sides. Specifically designed for interior use.
   1. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
   2. Core: 5/8 inch (15.9 mm), Type X.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Georgia-Pacific Gypsum LLC; DensArmour Plus.
      b. Lafarge North America; Weather Defense.
      c. National Gypsum Company; eXP Interior Extreme.
      d. Temple Inland; GreenGlass.
      e. USG Corporation; Sheetrock Brand Glass-mat Panels Mold Tough.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; FiberCement BackerBoard.
      b. Custom Building Products; Wonderboard.
      c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
      d. James Hardie Building Products, Inc.; Hardiebacker 500.
      e. National Gypsum Company, Permabase Cement Board.
      f. USG Corporation; DUROCK Cement Board.
   2. Thickness: 1/2 inch (12.7 mm).
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Paper-faced galvanized or aluminum-coated steel sheet, or rolled zinc.
      a. Shapes:
         1) Corner Bead.
         2) Bullnose bead.
         3) LC-Bead: J-shaped; exposed long flange receives joint compound.
         4) Expansion (control) joint.
         5) Curved-Edge Cornerbead: With notched or flexible flanges.
      b. Contractor Option for Corner Bead: No-Coat “Ultratrim” plastic units with paper facing are acceptable.
   2. Material: Aluminum extruded accessories of profiles and dimensions indicated.
      a. Shape: Basis of Design, Fry Reglet “V” Reveal Molding ¼” x ¼” DRMV-25.

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1) Fry Reglet Corp.
   2) Gordon, Inc.
   3) Pittcon Industries.

c. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

d. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Paper-Faced Gypsum Board: Paper.
   2. Glass-Mat-Faced Gypsum Board: Fiberglass mesh.
   3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: 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 compound.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:
   1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels: As recommended by backing panel manufacturer for Project applications.

F. Joint Compound for Solid Mineral Profile Paneling: As recommended by profile panel manufacturer for Project applications.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corporation, CertaPro AcoustaTherm Batts in walls and ceilings.
      b. Owens-Corning, Sound Attenuation Batts in walls; Sonobatts in ceilings.
      c. Thermafiber, Inc., Sound Attenuation Fire Blankets (SAFB) in walls and ceilings.

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Non-Rated Partitions:
      a. Pecora Corporation; AC-20 FTR; AIS-919 is acceptable for non-rated partitions.
      b. USG Corporation; SHEETROCK Acoustical Sealant. Exception: Where acoustical seals are needed at copper pipe penetrating gypsum board, provide one-part urethane sealant in white color; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   2. VOC Content: Maximum 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged or mold damaged.

C. Verify that temperature and humidity requirements specified in "Project Conditions" article will be maintained for duration of project.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING ACOUSTICAL ACCESSORIES

A. STC-Rated Assemblies: Comply with requirements of indicated GA assembly designs.

B. Comply with ASTM C919 and manufacturer's recommendations for location of acoustical sealant beads, and close off sound-flanking paths around or through the work, including sealing of partitions above acoustical ceilings.

C. Do not install sound attenuation blankets until mechanical and electrical work within framing spaces is complete.

D. Fill framing spaces for complete coverage after gypsum board has been installed on one side of partition.

E. Fit sound attenuation blankets tight around cut openings and penetrations, and behind and around electrical and mechanical items within framing spaces.

F. Pack blankets around door and window frames, between jamb studs, in boxed headers, and in other voids.

G. Provide wires or other means of mechanical supports to maintain full coverage and prevent slumping at tops of partitions and other displacement.

H. Where sound attenuation blankets are installed in partitions, seal perimeters, control and expansion joints, openings, and penetrations with continuous beads of acoustical sealant at both faces of partition.
   1. Apply acoustical seals to electrical boxes and other penetrations of gypsum board.

I. Where concealed acoustical sealant beads are required at floor line, apply sealant to clean floor surface first and set drywall boards into the sealant.

J. At other locations tool beads to ensure complete contact with joint surfaces. Where exposed, form smooth concave surface suitable for finish painting.

3.3 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Reference Standards: ASTM C840 and GA 216.

B. Do not begin installing paper-faced gypsum panels until building is weathertight and meets conditioned space requirements specified in article "Field Conditions".

C. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member. Install ceiling panels to provide light contact at edges and ends with no more than 1/16 inch (1.5 mm) gap between panels.

D. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
   1. Install panels on high priority walls first and then lesser priority walls as indicated and as required by authorities having jurisdiction.

E. Position boards so that like edges abut. Do not place tapered edges against cut edges or ends.

F. Stagger vertical joints over different studs on opposite sides of partitions.

G. Butt boards together for light contact at edges and ends and with not more than 1/16 inch open space between boards. Do not force boards into place.

H. Fit boards to ducts, pipes, conduit, and other penetrations and obstructions with maximum 1/4 inch joints.

I. Floor Slabs: Leave minimum 1/4 inch, maximum 1/2 inch space between floor slab and bottom edge of gypsum board.
   1. At Bottom of Deck (top of panel): Where gypsum board extends to bottom of deck, cope gypsum board to shapes of deck, structural supports, and other construction to fit tight against deck with maximum 3/4 inch gap.
   2. Hollow Metal Opening Frames:
      a. Install gypsum board with minimum 1/2 inch penetration into frame throat.
      b. Install all gypsum boards vertical, including areas above framed openings. Joints shall be tapered joints (not cut) and shall not occur at corner of frames, except at control joint locations.

J. 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.

K. Form control and expansion joints with space between edges of adjoining gypsum panels.

L. Offset joints between layers one framing space, but not less than 12 inches. Do not tape joints in base layer.

M. Spot grout hollow metal frames at each anchor clip.

N. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

O. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

1. Fasten boards to supports with screws. Fasten each layer of 2-ply applications separately with screws.

3.4 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: Vertical surfaces unless otherwise indicated.
   2. Flexible Type: Apply in double layer at curved assemblies.
   3. Moisture- and Mold-Resistant Type:
      a. Paperless: Inside face of all exterior walls; Walls subject to incidental wetting and not scheduled to receive tile, including but not limited to behind or adjacent to plumbing fixtures, showers, equipment with water connections, janitor sinks, clinical sinks, and scrub sinks.

B. Single-Layer Application:
   1. On ceilings in spaces where partitions do not extend above ceiling, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls/barriers, apply gypsum panels vertically (parallel to framing and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. Locate horizontal joints above finish ceiling, except where ceiling height is greater than 10'-0" (3m) in spaces without a ceiling horizontal joint shall be at 8'-0" (2.4m) minimum above finish floor.
   3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
      a. Attach all gypsum board with screws 3/8 inch to 1/2 inch from edges and space at no more than 8 inches on center at edges and 12 inches on center in the field or to comply with tested assembly, whichever are more stringent. Drive screws so head rests in slight dimple without cutting face surface or fracturing core.
   4. Comply with requirements of tested assembly indicated.

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. Curved Surfaces:
   1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12 inches (300-mm) long straight sections at ends of curves and tangent to them.
   2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.5 APPLYING TILE BACKING PANELS

A. Cementitious Backing Units: ANSI A108.11, at wet areas including but not limited to showers, water closets and where indicated.
   1. Install waterproof membrane over studs per recommendations
   2. Treat cuts, edges of utility holes, fastener beads, joints and intersections with thinned tile adhesive.

B. Limited Water Exposure Areas: Install moisture- and mold-resistant gypsum board panels immediately adjacent to showers and other wet areas to produce a flat surface.

C. Where tile backing panels abut other types of panels in same plane, shim boards to produce a uniform plane across panel surfaces. Fill joints per panel manufacturer's recommendations.

D. Space fasteners in panels that are tile substrates maximum 8 inches (203.2 mm) o.c.

3.6 INSTALLING TRIM ACCESSORIES

A. 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 according to ASTM C 840.
   1. Install double studs to create control joints, leave 1/2 inch separation between gypsum board panels for installation of control joint units.
   2. Routing gypsum board to create joint is not acceptable.

A. Control Joint Locations: Where indicated, but not less than the following.
   1. Locations of control and expansion joints in substrate or framing.
   2. Walls: Maximum 30 ft o/c; coordinate locations with Architect. Wall- or partition-height door frames may be considered as control joints.
   3. Ceilings: In ceilings larger than 2500 sq ft locate control joints maximum 50 ft o/c each way, and at all locations where framing or furring change direction. Coordinate locations with Architect.
   4. Joints between different types of materials in the same plane.

B. Interior Trim:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges.
   3. Curved-Edge Cornerbead: Use at curved openings.

C. Cornerbead: Install in single pieces at vertical corners.

D. Edge Trim: Install where edge of gypsum board would otherwise be exposed or semi-exposed.
   1. Install trim in a single piece on each side of opening perimeters with joints only at corners. If size of opening exceeds available length of edge trim, coordinate locations of joints with Architect.

E. Reveals: Install trim plumb, level, accurately aligned, and fitted neatly with hairline joints.
   1. Cut trim with sharp power saw and file cut edges to remove burrs.
   2. Miter joint at changes in direction or plane, except that inside corners may be coped.
   3. Install double studs to support reveal trim and gypsum board.
   4. For Rated Fire and Smoke Barriers and Non-Rated Smoke Partitions: Construct reveal to comply with detail for wall rating.
   5. Apply masking tape or other protection to reveal surfaces before starting drywall finishing to keep surfaces clean and free of finishing compound and other substances.
   6. Routing gypsum board to create reveal is not acceptable.

3.7 FINISHING GYPSUM BOARD

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 for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, locations indicated on Drawings.
   2. Level 2: Substrates for tile, substrates for solid surfacing material, locations indicated on Drawings.
   3. Level 3: Surfaces that receive Type II wall covering, locations indicated on Drawings.
   4. Level 4: Surfaces that receive flat and low-sheen paint except as otherwise noted, surfaces that receive Type I wall covering, and all other areas not otherwise noted.
   5. Level 5: Surfaces that receive gloss and semigloss paint, surfaces at edge-lit locations, locations indicated on Drawings.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

F. Solid Mineral Profile Paneling: Finish according to manufacturer’s written instructions.

3.8 FIELD QUALITY CONTROL

A. Above-Ceiling Observations: Before Contractor installs gypsum board ceilings, Architect will conduct above-ceiling observations and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect three calendar days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:

a. Installation of 80 percent of lighting fixtures, powered for operation.
b. Installation, insulation, and leak and pressure testing of water piping systems.
c. Installation of air-duct systems.
d. Installation of air devices.
e. Installation of mechanical system control-air tubing.
f. Installation of ceiling support framing.
g. Installation of access panel support framing.
h. Installation of ceiling mounted equipment supports.
i. Installation of supports for ceiling mounted products.

3.9 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, humidity, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, or 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

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Porcelain tile.
2. Glass tile.
3. Crack isolation membrane.
4. Metal edge strips.
5. Grout for tile.
6. Setting Mortars and adhesives.

B. Related Sections:
1. Section 07 9200 - Joint Sealants: Sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 2900 - Gypsum Board: Cementitious backer units.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Module Size: Actual tile size plus joint width indicated.

C. Face Size: Actual tile size, excluding spacer lugs.

1.3 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028.
1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum0.6.
3. Ramp Surfaces: Minimum 0.8.

1.4 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
1. Each required type of tile.
2. Setting and grouting materials.
3. Waterproofing and crack suppression membranes.
4. Shower pans.
5. Trim accessories.

C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch (150-mm) lengths.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated, but not less than one full box each.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Experienced installer who has completed tile installations similar in material, design, complexity, and size to tile work indicated for this Project and that have successful in-service performance.

B. Reference Standards: Perform Work in accordance with applicable portions of the following publications.
   1. ANSI A137.1 - Standard Specifications for Ceramic Tile
   2. TCNA - Handbook for Ceramic Tile Installation.

C. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

D. Source Limitations for Setting and Grouting Materials: Obtain ingredients of uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

E. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Waterproof membrane.
   2. Crack isolation membrane.
   3. Cementitious backer units.
   4. Metal edge strips.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

C. Store tile and cementitious materials on elevated platforms, under cover, and in dry locations.

D. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

E. Store liquid materials in unopened containers and protected from freezing.

F. Handle tile that has temporary protective 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.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of one box of full-size units for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout with factory-applied continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Specific tile products, including colors, are specified on Drawings.

1. Source: Tile market of San Marco; Shirley Ford; shirley.ford@comcast.net; 904-738-1643 (mobile).

B. Tile Type [**PORC T**]: Factory-mounted glazed ceramic tile.
1. Manufacturers: See Interior Design Finish Legend and Plan for selected manufacturer's products and colors specified.
2. Composition: Porcelain.
3. Module Size: 12 inches by 24 inches.
4. Thickness: 3/8 inch (9.5 mm).
5. Face: Pattern of design indicated, with cushion edges.
6. Surface: Smooth, without abrasive admixture.
7. Finish: As indicated by manufacturer's designations.
8. Tile Color and Pattern: As indicated by manufacturer's designations.
9. Grout Color: As selected by Architect from manufacturer's full range.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. Base for Thin-Set and Medium-Bed Mortar Installations: straight, module size 12 inches by 24 inches.

C. Tile Type [**GL T**]: Glass wall tile.
1. Manufacturers: See Interior Design Finish Legend and Plan for selected manufacturer's products and colors specified.
2. Module Size: 1 inch by 4 inch brick.
3. Face: Pattern of design indicated, with manufacturer's standard edges.
4. Finish: Pearl glaze.
5. Tile Color and Pattern: As indicated by manufacturer's designations.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Mounting: Factory, back mounted.

2.3 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. MAPEI Corporation; Mapeguard and MAPEI SM Primer.
    b. National Applied Construction Products, Inc.; Strataflex.

C. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. MAPEI corporation; Mapelastic Smart.
    b. Merkrete Products, Inc.; Fracture-Guard 5000.
    c. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.

d. TEC; a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.
e. MAPEI, Mapelastic CI.

2.4 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4 and ISO 13007 C2TES1P1 / C2TE.
1. Basis-of-Design Product: Subject to compliance with requirements, provide MAPEI Corporation - Ultraflex LFT or Adsilex P10 (glass) or comparable product by one of the following:
a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. Merkrete Products, Inc.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

B. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4 and ISO 13007 C2TES1P1. Provide product that is approved by manufacturer for application thickness of 3/4 inch.
1. Basis-of-Design Product: Subject to compliance with requirements, provide MAPEI Corporation - Ultraflex LFT or comparable product by one of the following:
a. Bonsal American; an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Jamo Inc.
f. Laticrete International, Inc.
g. Merkrete Products, Inc.
h. Southern Grouts & Mortars, Inc.
i. Summitville Tiles, Inc.
j. TEC; a subsidiary of H. B. Fuller Company.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.

2.5 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout (for PORC T): ANSI A118.3 and ISO 13007 R2/RG, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.
1. Basis-of-Design Product: Subject to compliance with requirements, provide MAPEI Corporation - Kerapoxy CQ or comparable product by one of the following:

a. Atlas Minerals & Chemicals, Inc.
b. Boiardi Products; a QEP company.
c. Bonsal American; an Oldcastle company.
d. Bostik, Inc.
e. C-Cure.
f. Custom Building Products.
g. Jamo Inc.
h. Laticrete International, Inc.
i. Parex Merkrete.
j. Southern Grouts & Mortars, Inc.
k. Summitville Tiles, Inc.
l. TEC; a subsidiary of H. B. Fuller Company.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

B. Urethane and Colored Quartz – Based Grout (for **GL T**).
1. Basis-of-Design Product: Subject to compliance with requirements, provide Star Quartz – Quartzlock and Star Glass or comparable product.
a. Color: As indicated on Interior Design Finish Listing Drawing D0.1.
b. Source: Bill Patin, Distric Sales Manager, Crossville Tile and Stone; bpatin@crossvilleinc.com; 904-527-0160 (mobile).

2.6 ACCESSORY MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

A. Metal Edge Strips for Walls: Square shape, height to match tile and setting-bed thickness, metallic, designed specifically for wall tile applications; **stainless-steel, ASTM A 666, 300 Series** exposed-edge material.
1. Basis of Design: Schluter Systems; Schluter-QUADEC.

B. Metal Edge Strips for Floors: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; **stainless-steel, ASTM A 666, 300 Series** exposed-edge material.
1. Basis of Design: Schluter Systems; Schluter-SCHIENE.

C. Metal Transition Strips: Angle type, height to match tile and setting-bed thickness, designed specifically for flooring applications, **stainless-steel, ASTM A 666, 300 Series** exposed-edge material.
1. Schluter Systems; Schluter-RENO-U.

D. Metal Cove Strip: Cove shape, depth to match tile and setting-bed thickness, metallic, designed specifically for wall and floor tile applications, stainless-stee, ASTM A 666, 300 Series exposed-edge material.
1. Basis of Design: Schluter Systems: Schluter-DILEX-HKU.

E. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
   2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

F. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Bonsal American; an Oldcastle company; Grout Sealer.
      b. C-Cure; Penetrating Sealer 978.
      c. MAPEI Corporation MAPEI "UltraCare Stone, Tile & Grout Care Solutions.
      d. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
      e. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

G. Tile Cleaner: Neutral cleaning product capable of removing soil and residue without harming tile and grout surfaces, and specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.

b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Concrete Moisture Testing: Perform anhydrous calcium chloride test, ASTM F1869. Proceed with installation only after subtrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

1. Perform tests so that each test area does not exceed 200 sq. ft.(18.6 sq. m), and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.

3.2 PREPARATION

A. Remove substrate coatings, residual adhesive, adhesive removers and other substances that contain soap, wax, or oil using mechanical methods. Do not use solvents.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
   c. Tile floors composed of rib-backed tiles.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths.
   1. Porcelain Tile: 1/8 inch (3.2 mm).
   2. Glass Tile: same width as joints within tile sheets.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Prepare joints and apply sealants per Section 07 9212.

I. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKER PANEL INSTALLATION

A. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but not sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCNA F125A, ANSI A108.1C.
      a. Tile Type: PORC T.
      b. Thin-Set Mortar: Medium-bed, latex- portland cement mortar.
      c. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations, Metal Studs or Furring:
   1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCNA W244.
      a. Tile Type: PORC T.
      b. Thin-Set Mortar: Latex-portland cement mortar.
      c. Grout: Water-cleanable epoxy grout.
   2. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCNA W244.

a. Tile Type: GL T.
b. Thin-Set Mortar: Latex-portland cement mortar.
c. Grout: Urethane and Colored Quartz–Based Grout .

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of product.

C. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. General: Provide ceilings panels and suspension systems to comply with the requirements in this section and the Ceiling System Schedule at the end of Part 3.

D. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

E. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

F. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.3 ACOUSTICAL PANELS AP-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc., ULTIMA Tegular; Number 1911 or comparable product:
1. USG Interiors, Inc.; Subsidiary of USG Corporation; Mars ClimaPlus; Number 86785.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type IV, mineral base with membrane faced overlay; Form 2, water felted.
2. Pattern: E (lightly textured).

C. Color: White.

D. LR: Not less than 0.89.

E. NRC: Not less than 0.70.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Beveled Tegular.

H. Thickness: 3/4 inch (19 mm).

I. Modular Size: 24 by 24 inches (610 by 610 mm).

J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 ACOUSTICAL PANELS AP-2

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc., ULTIMA Tegular; Number 1914 or comparable product:
1. USG Interiors, Inc.; Subsidiary of USG Corporation; Mars ClimaPlus; Number 88785.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type IV, mineral base with membrane faced overlay; Form 2, water felted.
2. Pattern: E (lightly textured).

C. Color: White.

D. LR: Not less than 0.89.

E. NRC: Not less than 0.70.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Beveled Tegular.

H. Thickness: 3/4 inch (19 mm).

I. Modular Size: 24 by 48 inches (610 by 1220 mm).

J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than [0.106-inch (2.69-mm-)] [0.135-inch (3.5-mm-)] diameter wire.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

2.6 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc. product as scheduled, or a comparable product:
   1. USG Interiors, Inc.; Subsidiary of USG Corporation, DX/DXL.

B. Ceiling Grid G-1: Wide-Face, Capped, Double-Web, Fire-Rated Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch (24-mm-) wide metal caps on flanges.
   1. Product: Armstrong World Industries, Inc.: Prelude Grid.
   2. Structural Classification: Intermediate-duty system.
   3. End Condition of Cross Runners: Override (stepped) or butt-edge type.
   4. Face Design: Flat, flush.
   5. Cap Material: Steel cold-rolled sheet.
   6. Cap Finish: Painted to match color of acoustical unit.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
   4. For suspension systems required to meet Seismic Design Category D, E, or F provide grid end retaining clip with horizontal slot to join wall molding and web of grid without visible pop rivets.
   5. Product: Subject to compliance with requirements provide Armstrong World Industries, Inc.: BERC2 or comparable product by another manufacturer.

2.8 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

b. USG Corporation; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately, with no visible gaps, into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.

5. For reveal-edged panels where a full tile cannot be installed, cut reveal or rabbit to match factory edge at all border areas and vertical surfaces.
6. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
   1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
      a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
      b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

C. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.6 CEILING SYSTEM SCHEDULE

Ceiling System	Panel	Grid	Hold-Down Clips
AT-1	AP-[1]	G-[1]	No
AT-2	AP-[2]	G-[1]	No

NOTE: See Reflected Ceiling Plan for locations of ceiling systems.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Resilient base.
2. Resilient molding accessories.
3. Concrete vapor sealer.

B. Related Sections:
1. Division 09 Section "Resilient Sheet Flooring" for resilient sheet floor coverings.
2. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

C. Product Schedule: For resilient products, use same designations indicated on Drawings.

D. Concrete Sealer Installer Certification: Manufacturer's written certification for installer.

E. Concrete Vapor Sealer Manufacturer's Statement: Stating that concrete vapor sealer manufacturer warrants that flooring adhesive will bond to concrete vapor sealer.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Concrete Sealer Installer Qualifications: Installer trained and certified by sealer manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.5 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Store in location as directed by Owner and obtain a signed receipt.
   1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE RB-1

A. Manufacturers: Subject to compliance with requirements, provide products by Johnsonite.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TP (rubber, thermoplastic).
   2. Manufacturing Method: Group I (solid, homogeneous).
   3. Style: Millwork Contoured Wall Base, Mandalay MW-XX-H.

C. Minimum Thickness: 0.375 inches (9.52 mm).

D. Height: 4.5 inches (11.43 cm).

E. Lengths: Lengths in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Finish: Low luster.

I. Colors and Patterns: As indicated by manufacturer's designations in Finish Legend and Schedule.

2.2 RESILIENT BASE RB-2

A. Manufacturers: Subject to compliance with requirements, provide products by Johnsonite.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TP (rubber, thermoplastic).
   2. Manufacturing Method: Group I (solid, homogeneous).
   3. Style: Cove (base with toe) at resilient floor; Straight at carpet..

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Finish: Low luster.

I. Colors and Patterns: As indicated by manufacturer's designations in Finish Legend and Schedule.

2.3 RESILIENT MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by Johnsonite.

B. Description: Cap for cove resilient floor covering, Transition strips, Cove filler strips.

C. Material: Rubber.

D. Profile and Dimensions: Johnsonite Cove Cap SCC-XX-B; Transition strip CTA-XX-A; Cove filler profile/size as recommended by resilient floor covering manufacturer.

E. Colors and Patterns: As indicated by manufacturer's designations in Finish Legend and Schedule.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

2.5 ACCESSORY MATERIALS

A. Concrete Vapor Sealer: Inorganic vapor sealer and crack filler specifically developed to provide a vapor seal. Provide product recommended by manufacturer for moisture content of concrete.
   1. Manufacturers:
      a. Concure Products, Inc.; Concure Vapor Barrier System.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Accessories: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Moisture Mitigation: When moisture content of concrete exceeds maximum limits install concrete crack filler and vapor sealer in accordance with manufacturer's written instructions.
   1. After installation of vapor sealer and prior to flooring installation, conduct a 72-hour bond test to determine adhesion of flooring adhesive to concrete vapor sealer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
   1. Concrete surfaces shall be smooth and flat with maximum variation of 1/8 inch in 10 feet, and ready to receive materials.

E. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned. Lengths less than 48 inches are not acceptable.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible. Cut pieces at corner joint to provide miter at bottom cove and fit tight to wall.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vinyl sheet flooring.
   2. Concrete vapor sealer.

B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for accessories installed with resilient flooring.

1.2 SEQUENCING

A. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

B. Install resilient sheet flooring before installation of base cabinets.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Each type of resilient sheet flooring.
   2. Adhesives for resilient sheet flooring.
   3. Concrete vapor sealer.

B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each different color and pattern of resilient sheet flooring required.
   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

1.4 INFORMATIONAL SUBMITTALS

A. Report on adhesion testing of flooring adhesives to concrete vapor sealer and other substrate treatments.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

B. Manufacturer warranties.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Resilient Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive resilient sheet flooring during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. FloorScore Compliance: Resilient sheet flooring shall comply with requirements of FloorScore certification.

C. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 RESILIENT SHEET FLOORING

A. Proprietary resilient sheet flooring products, including colors and patterns, are specified on Drawing Sheet D0.1.

2.3 ACCESSORY MATERIALS

A. Concrete Vapor Sealer: Inorganic moisture control system specifically developed to provide a vapor seal. Provide product recommended by manufacturer for moisture content of concrete.
1. Manufacturers:
   a. Concure Products, Inc.; Concure Vapor Barrier System.
   b. Ardex Americas; Ardex MC Plus.
   c. Ardex Americas; Ardex MC Ultra.
   d. Ardex Americas; Ardex MC Rapid.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
1. Gypsum-based materials are not acceptable.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
1. Healthcare Facilities: Use only epoxy type adhesive unless otherwise indicated.
2. Adhesives shall have a VOC content of 50 g/L or less.

C. Seamless-Installation Accessories:
1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
   a. Color: As selected by Architect from manufacturer's full range to contrast with flooring.

D. Integral-Flash-Cove-Base Accessories:
1. Cove Strip: 1-inch (25-mm) radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Refer to Division 09 Section "Resilient Base and Accessories" for specification.

E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:
      a. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates fall within range recommended by manufacturer in writing or have a maximum 75 percent relative humidity level.

C. Concrete Vapor Sealer: Where moisture content of concrete exceeds maximum limits, install concrete crack filler and vapor sealer in accordance with manufacturer's written instructions.
   1. After installation of vapor sealer and before flooring installation, conduct 72-hour bond test to verify adhesion of each required type of flooring adhesive to concrete vapor sealer. Provide written report on such testing.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.
   1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:
   1. Lay sheets parallel to room walls, unless otherwise indicated.
   2. Maintain uniformity of flooring direction.
   3. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.
   4. Match edges of flooring for color shading at seams.
   5. Avoid cross seams.
   6. Butt all seams neatly and tightly before heat welding.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
   1. Install resilient flooring in epoxy adhesive unless otherwise indicated.

I. Seamless Installation:
   1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

J. Integral-Flash-Cove Base: Cove resilient sheet flooring 4 inches (102 mm) except in toilet or shower rooms where it shall be 6 inches (152 mm) up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.
   1. Apply as recommended by manufacturer..

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid vinyl floor tile.
   2. Vinyl composition floor tile.
   3. Concrete vapor sealer.

B. Related Sections:
   1. Section 09 6513: Resilient wall base and accessories for accessories installed with resilient flooring.

1.2 SEQUENCING

A. Install floor tile after other finishing operations, including painting, have been completed.

B. Install floor tile before installation of base cabinets.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Each type of floor tile.
   2. Adhesives for floor tile.
   3. Concrete vapor sealer.

B. Shop Drawings: Show details of special patterns.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.4 INFORMATIONAL SUBMITTALS

A. Report on adhesion testing of flooring adhesives to concrete vapor sealer and other substrate treatments.

B. Concrete Vapor Sealer Manufacturer's Statement: Stating that concrete vapor sealer manufacturer warrants that flooring adhesive will bond to concrete vapor sealer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

B. Manufacturer warranties.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

2. Store extra materials in building where directed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications – Floor Tile: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

B. Installer Qualifications – Concrete Vapor Sealer: Acceptable to manufacturer and employing factory-trained installers.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.

C. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and

Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 FLOOR TILE

A. Proprietary tile products, including colors and patterns, are specified on Drawing Sheet D0.1.

2.3 ACCESSORY MATERIALS

A. Concrete Vapor Sealer: Inorganic moisture control system specifically developed to provide a vapor seal. Provide product recommended by manufacturer for moisture content of concrete.
   1. Manufacturers:
      a. Concure Products, Inc.; Concure Vapor Barrier System.
      b. Ardex Americas; Ardex MC Plus.
      c. Ardex Americas; Ardex MC Ultra.
      d. Ardex Americas; Ardex MC Rapid.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
   1. Healthcare Facilities: Use only epoxy type adhesive unless otherwise indicated.
   2. Adhesives shall comply with the following limits for VOC content:
      a. Vinyl Composition Tile Adhesives: 50 g/L or less.

C. Floor Polish: Protective, liquid floor-polish products recommended by floor tile manufacturers for Project applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
    a. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates fall within range recommended by manufacturer or have a maximum 75 percent relative humidity level.

C. Concrete Vapor Sealer: Where moisture content of concrete exceeds maximum limits, install concrete crack filler and vapor sealer in accordance with manufacturer's written instructions.
1. After installation of vapor sealer and before flooring installation, conduct 72-hour bond test to verify adhesion of each required type of flooring adhesive to concrete vapor sealer. Provide written report on such testing.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles square with room axis in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
   1. Install resilient flooring in epoxy adhesive unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

B. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. Provide hardboard, heavy cardboard, or other panel protection in areas subject to high traffic and wheeled traffic.

C. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply number of coats as recommended by manufacturer.

D. Cover floor tile until Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular, tufted carpet tile.
   1. Concrete vapor sealer.

B. Related Requirements:
   1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Type, color, and location of edge, transition, and other accessory strips.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Carpet Tile and Concrete Sealer Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Concrete Vapor Sealer Manufacturer's Statement: Stating that concrete vapor sealer manufacturer warrants that flooring adhesive will bond to concrete vapor sealer.

D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m). Store in location as directed by Owner.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II or Master II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.

3. Warranty Period: 10 years minimum from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Product: Subject to compliance with requirements, provide the following Carpet Tile (**CPT**):
1. Shaw Contract Group.
   a. Pattern and Color: As indicated in Finish Legend Schedule.
   b. Source: Rebecca Crosby, Corporate Accounts Manager / A&D Specialist; rebecca.crosby@shawinc.com; 904-517-3308 (mobile).
2. Fiber Content: 100 percent nylon 6, 6.
3. Fiber Type: eco*solution Q nylon.
4. Pile Characteristic: Multi-Level Pattern Cut/Loop pile.
5. Density: 5,581 oz./cu. yd. (10.39 kilotex).
6. Stitches: 13 stitches per inch (.512 per mm).
7. Gage: .10 ends per inch (.394 mm).
8. Primary Backing/Backcoating: synthetic; consult manufacturer.
9. Secondary Backing: proprietary high performance thermoplastic polyolefin compound with fiberglass reinforcing layer .
10. Backing System: eco*worx tile.
11. Size: 24 by 24 inches (610 by 610 mm).
12. Installation Method: monolithic.

B. Product: Subject to compliance with requirements, provide the following Walk-Off Mat (WOM):
1. Mannington Commercial
   a. Pattern and Color: As indicated in Finish Legend Schedule.
   b. Source: Amy Hubbell, District Manager; amy_hubbell@mannington.com; 904-669-9008 (mobile/office).
2. Fiber Content: Type 6,6 Post Production Nylon Plus Scraper Fiber.
3. Pile Characteristic: Tip-Sheared Loop.
4. Pile Thickness: .161 inches (4.09 mm) for finished carpet tile according to ASTM D 6859.
5. Density: 7,155 oz./cu. yd. (265.86 kg/cu. m).
6. Stitches: 13.83 stitches per inch (.545 per mm).
7. Gage: 1/12 per inch (.472 per mm).
8. Primary Backing/Backcoating: 100 % synthetic; consult manufacturers.
9. Secondary Backing: Manufacturer's standard material.
10. Backing System: Infinity RE Modular.
11. Size: 24 by 24 inches (610 by 610 mm).
12. Installation Method: monolithic.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, residual adhesive, adhesive removers, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Moisture Mitigation: When moisture content of concrete exceeds maximum limits install concrete crack filler and vapor sealer in accordance with manufacturer's written instructions.
1. After installation of vapor sealer and prior to flooring installation, conduct a 72-hour bond test to determine adhesion of flooring adhesive to concrete vapor sealer.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders or in direction as indicated on Drawings.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Concrete.
   2. Concrete masonry units (CMU).
   3. Steel.
   4. Galvanized metal.

B. Related Sections include the following:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section structural steel.
   2. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
   3. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
   4. Division 09 painting Sections for special-use coatings.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.3 QUALITY ASSURANCE

A. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

B. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.5 PROJECT CONDITIONS

A. Apply paints only when of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Label each container with color, texture, sheen and location/room, in addition to the manufacturer's label.
   2. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As indicated in a Finish Schedule.

2.2 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: Waterborne, high solids, emulsion type pigmented coating with bridging and filling properties for interior or exterior concrete masonry units.
   1. Benjamin Moore; Moorecraft Super Craft Latex Block Filler No. 285-01.
   2. Coronado Paint; Super Kote 5000 Commercial Latex Block Filler No. 946-11.
   3. Duron; Dura Crete H.P. Acrylic Block Filler No. 16-110.
   4. ICI Paints; Devoe Coatings Bloxfil Acrylic Block Filler No. 4000-1000.
   5. PPG; Speedhide Int/Ext. Latex Block Filler No. 6-15.
   6. Sherwin-Williams; PrepRite Int/Ext Block Filler No. B25W25.

2.3 PRIMERS/SEALERS

A. Alkali-Resistant Primer: Solvent or water-based, alkali resistant primer used on alkaline surfaces.
   1. Coronado Paint; Elast-O-Meric Clear Masonry Primer Sealer No. 43-10.
   2. ICI Paints; Devoe Coatings Devshield No. 4130-6130.
   3. PPG; Pittsburgh Paints Speedhide Interior/Exterior Alkali Resistant Primer No. 6-603C.
   4. Sherwin-Williams; Loxon Acrylic Primer No. A24W300.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint system indicated.

2.4 METAL PRIMERS

A. Quick-Drying Alkyd Metal Primer: Solvent based, modified alkyd, fast drying, lead and chromate free, anticorrosive primer.
   1. Coronado Paint; Quick Dry Alkyd Metal Primer No. 895 Line.
   2. Duron; Duron Dura Clad Fast Dry Universal Primer No. 33-042.
   3. ICI Paints; Devoe Coatings Devguard T&S Primer No. 4160.
   4. PPG; Multiprime Fast Dry 2.8 VOC No. 94-258/269.
   5. Sherwin-Williams; Industrial & Marine Kem Kromic Alkyd Metal Primer No. B50 WZ1.

B. Cementitious Galvanized-Metal Primer: Solvent based primer composed of linseed oil/alkyd resin and Portland cement.
   1. Sherwin-Williams; Industrial & Marine Opti-Bond Multi Surface Coating No. B50W100.

2.5 EXTERIOR LATEX PAINTS

A. Exterior Latex (Flat): White or colored, flat, waterborne paint.
   1. Benjamin Moore; MoorLife Latex House Paint 105-01.
   2. Coronado Paint; Premium Gold Collection Acrylic One Coat Flat House Paint No. 10-1.
   3. Duron; Weathershield Ext. 100% Acrylic Flat House Paint No. 34-914.
   4. ICI Paints; Dulux Fortis No. 6201V.
   5. PPG; Sun-Proof Exterior Flat Latex No. 72-110.
   6. Sherwin-Williams; A-100 Exterior Latex Flat No. A6W16.

B. Exterior Latex (Semigloss): Pigmented, water based, emulsion type, semi-gloss paint.
   1. Coronado Paint; Supreme Collection Acrylic Semi-Gloss House Paint No. 12-1.
   2. Duron; Weathershield Ext. Acrylic House Paint S.G. No. 03-914.
   3. ICI Paints; Dulux Fortis No. 6407X.
   4. PPG; S/G Latex House Paint No. 78-45.
   5. Sherwin-Williams; A-100 Exterior Gloss Latex No. A8W16.

2.6 QUICK-DRYING ENAMELS

A. Quick-Drying Enamel (Semigloss): Quick drying, pigmented, semi-gloss solvent-based alkyd (or modified alkyd) enamel.

1. Benjamin Moore; D.T.M. Alkyd Semi-Gloss No. M24.
2. Coronado Paint; Tough Shield Polyurethane Rust Inhibitive S.G. No. 1213 Series.
3. PPG; High Performance Industrial Semi-Gloss Oil No. 7-844.
4. Sherwin-Williams; Industrial & Marine Industrial Enamel No. B54Wseries.

B. Quick-Drying Enamel (High Gloss): Quick drying, pigmented, solvent-based alkyd (or modified alkyd) gloss enamel.
1. Benjamin Moore; Rapid Dry Gloss Enamel No. CM20.
2. Coronado Paint; Quick Dry Alkyd Gloss Enamel No. 139 Line.
3. Duron; ICI Paints; Devoe Coatings Devguard Alkyd Industrial Enamel No. 4308.
4. PPG; Quick Drying Gloss Enamel No. 95-9000.
5. Sherwin-Williams; Industrial & Marine Steel Spec Fast Dry Alkyd No. B55-800 series.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
3. Do not paint locks and latching mechanisms of access panels.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions

E. Concrete Masonry Substrates: Remove efflorescence and surfaces to be painted exceeds that permitted in manufacturer's written instructions.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
   3. Do not paint locks and latching mechanisms of access panels.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
   1. Latex System:
      a. Prime Coat: Exterior latex matching topcoat.
      b. Intermediate Coat: Exterior latex matching topcoat.
      c. Topcoat: Exterior latex (flat).
   2. Latex Over Alkali-Resistant Primer System: Use where pH is greater than 8.0.
      a. Prime Coat: Alkali-resistant primer.
      b. Intermediate Coat: Exterior latex matching topcoat.
      c. Topcoat: Exterior latex (flat).

B. CMU Substrates:
   1. Latex System:
      a. Prime Coat: Interior/exterior latex block filler.
      b. Intermediate Coat: Exterior latex matching topcoat.
      c. Topcoat: Exterior latex (flat).

C. Steel Substrates:
   1. Quick-Drying Enamel System:
      a. Prime Coat: Quick-drying alkyd metal primer.
      b. Intermediate Coat: Quick-drying enamel matching topcoat.
      c. Topcoat: Quick-drying enamel (semigloss).

D. Galvanized-Metal Substrates:
   1. Latex System:
      a. Prime Coat: Cementitious galvanized-metal primer.
      b. Intermediate Coat: Exterior latex matching topcoat.
      c. Topcoat: Exterior latex (semigloss).

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Site-applied paint.
2. Painted signs for identifying fire and smoke walls above ceilings.

B. Related Sections:
1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
3. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
4. Division 09 Section "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: Product Data are not required for proprietary products named herein. Submit complete list of proposed products from other manufacturers indexed to specified proprietary products.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.
5. Matching of colors specified by proprietary designations is an aesthetic judgment of Architect. Re-submit color samples as requested until satisfactory matches are achieved, as acceptable to Architect.

1.3 CLOSEOUT SUBMITTALS

A. Color Records: Submit sufficient technical information on base colors and tinting for each selected color to enable Owner to reproduce colors in the future. Include color records in Operation and Maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Deliver materials to site in unopened original packaging with intact labels bearing product name and application recommendations. Identify each paint container for topcoats with color name and number.

C. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and solvent-containing waste from storage areas daily.

1.5 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Label each container with color, texture, sheen and location/room, in addition to the manufacturer's label.
   2. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
   1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
   2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
   3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   4. Floor Coatings: VOC not more than 100 g/L.
   5. Shellacs, Clear: VOC not more than 730 g/L.
   6. Shellacs, Pigmented: VOC not more than 550 g/L.
   7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
   8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
   9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   10. Floor Coatings: VOC not more than 100 g/L.

11. Shellacs, Clear: VOC not more than 730 g/L.
12. Shellacs, Pigmented: VOC not more than 550 g/L.
13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:
    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

D.

E. Colors: The Architect will select proprietary colors from any manufacturer, and may select colors from more than one manufacturer. The Architect will provide a schedule of colors and their locations. Match colors selected by Architect.

F. Colors: As indicated in Finish Schedule.

2.2 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: White, pigmented, waterborne latex sealer used on new interior plaster, concrete and paper-faced gypsum wallboard surfaces.
   1. Benjamin Moore; Regal First Coat Latex Primer/Undercoater No. 216.
   2. Coronado Paint; Super Kote 5000 Latex Primer-Sealer No. 40-11.
   3. ICI Paints; Prep-N-Prime Interior Latex Wall Primer No. 1000-1200.
   4. PPG; Speedhide Int. Latex Primer Sealer No. 6-2.
   5. Sherwin-Williams; PrepRite 200 Interior Latex Primer No. B28W200.

B. Interior High Solids Primer/Sealer: White, pigmented, waterborne latex surfacer used on new glass-mat-faced gypsum wallboard surfaces. Minimum 40 percent volume solids.
   1. ICI Paints: Glidden Gripper Primer/Sealer No. GL 3210-1200.
   2. PPG: 17-921 Seal Grip 100% Acrylic Int/Ext Primer.
   3. Sherwin-Williams: Builders Solution System No. A63W100.
   4. Valspar: American Tradition Multi-Purpose Primer No. 168215.

2.3 LATEX PAINTS

Gloss Level	Description	Units at 60 degrees	Units at 85 degrees
1	Matte or Flat finish	0 to 5	10 maximum
2	Velvet finish	10 maximum	10 to 35
3	Eggshell finish	10 to 25	10 to 35
4	Satin finish	20 to 35	35 minimum
5	Semi-Gloss finish	35 to 70	
6	Gloss finish	70 to 85	

A. Institutional Low-Odor/VOC Latex (Flat): White or colored latex paint with low odor characteristics and a VOC of less than 10 grams per liter.
   1. Benjamin Moore; Pristine Eco Spec Int. Latex Flat No. 219.
   2. ICI Paints (Canada); CIL Select-Int. Acrylic Velvet Flat No. 7100.
   3. M.A.B. Paints; Enviro Pure Latex Flat No. 040.
   4. PPG; Speedhide 0 Interior Flat 6-4110 Series.
   5. Sherwin-Williams; ProMar 200 Zero VOC Interior Flat (B30-2600).

B. Institutional Low-Odor/VOC Latex (Semigloss): White or colored latex paint with low odor characteristics and a VOC of less than 10 grams per liter.
   1. Benjamin Moore; Pristine Eco Spec Int. Latex Semi-Gloss Enamel No. 224.
   2. Duron; Genesis Odor Free High-Performance Int. Latex S.G. No. 83-914.
   3. ICI Paints; Lifemaster 2000 Interior Semi-Gloss No. LM 9200.
   4. PPG; Speedhide 0 Interior Semi Gloss Enamel 6-4510 Series.
   5. Sherwin-Williams; ProMar 200 Zero VOC Interior Semigloss (B31-2600).

C. High-Performance Architectural Latex (Semigloss): High performance architectural latex coating, Gloss Level 5 - Semi-Gloss.
   1. Benjamin Moore; Benjamin Moore DTM Acrylic Semi-Gloss No. M29-1B.
   2. ICI Paints; Dulux Professional Semi-Gloss Int. Wall and Trim Enamel No. 1406-0110.
   3. PPG; Speedhide Int. Semi-Gloss Latex No. 6-500.
   4. Sherwin-Williams; Industrial & Marine Sher-Cryl HPA Semi-Gloss No. B66W351.

2.4 EPOXY PAINTS

A. Interior/Exterior Epoxy W.B.: Waterborne, two component epoxy type, finish coating for prepared interior and exterior surfaces.
   1. Benjamin Moore; Acrylic Epoxy Gloss "A"; Hardener "B" No. M43/M44.
   2. Coronado Paint; Water-based Amine Adduct Epoxy No. 142 Line.
   3. ICI Paints; Devoe Coatings Tru-Glaze Acrylic Epoxy Coating No. 4418.
   4. PPG; Aquapon Waterborne Epoxy No. 98-1/98-98.
   5. Sherwin-Williams; Industrial & Marine Water Based Catalyzed Epoxy No. B70W Series.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Maximum Moisture Content of Substrates: Measure moisture content with an electronic moisture meter. Where moisture content exceeds recommended limits, allow surface to dry.
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMU): 12 percent.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.
   5. Plaster: 12 percent.

B. Concrete and Masonry Surfaces: Verify that alkalinity is within recommended limits.

C. Verify that primer coats provided under other sections are compatible with selected finish coats.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION – SUBSTRATES

A. Protect other construction from paint and damage caused by painting operations. Repair damage resulting from inadequate protection.

B. Leave intact temporary protective wrappings provided for protection of other work until completion of painting operations.

C. Prepare surfaces to be painted per paint manufacturer's recommendations for Project applications.

D. Correct defects and deficiencies in surfaces that would adversely affect painting work.

E. Remove hardware, accessories, electrical plates, plumbing escutcheons, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. Label removed items for re-installation in correct locations. Protect removed items during storage.
2. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
3. Restore or replace removed items that are missing or damaged during removal, storage, or re-installation.

F. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants. Remove oil and grease before mechanical cleaning. Schedule cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

G. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalking. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

H. Concrete Masonry Substrates: Remove efflorescence and chalking. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

I. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

J. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

K. Shop-Primed Substrates: Remove dirt, oil, and other contaminants. Touch up bare and damaged areas of primer.

L. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

M. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

N. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 PREPARATION – MATERIALS

A. Mix and prepare painting materials in accordance with manufacturer recommendations.

B. Maintain containers used in mixing and application of paint in clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and proper consistency.

D. Use thinners only as recommended by paint manufacturer.

3.4 APPLICATION

A. Comply with applicable requirements of Section 01 7300.

B. General:
1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and back [interior] sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces. Do not paint locks and latching mechanisms of access panels.
4. Ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive dry film thickness equivalent to that of flat surfaces.
5. Omit first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated.
6. Allow each coat to dry before applying next coat so that application of next coat of paint does not cause lifting, loss of adhesion, or other damage to undercoats.
7. Where wall base will be installed, extend epoxy paint no more than 1/2 inch below top of base.

C. Interior Surfaces to be Painted: Paint all exposed surfaces in areas scheduled to be painted except items in the following categories.
1. Prefinished and factory-finished items, except as otherwise indicated.
2. Finished metal surfaces.
3. Items with integral or natural finish.
4. Operating parts.
5. Nameplates, Underwriters' Laboratories labels, and similar items.
6. Concealed Mechanical or Electrical work, except as specifically noted.

D. Sequencing:
1. Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Apply primer and top coats to joint surfaces that receive elastomeric sealants.
3. Do not apply finish coats until paintable caulking has been applied.

E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

F. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

G. Prime wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.

H. Back prime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back sides.

I. Seal tops, bottoms, and cutouts of unprimed wood doors with heavy coat of varnish or sealer immediately upon delivery.

3.5 PAINTING MECHANICAL AND ELECTRICAL WORK

A. Paint items exposed in **[equipment rooms and]** occupied spaces.

B. Paint Piping: Colors indicated in Part 3 "Interior Painting Schedule".

C. Mechanical Work:
1. Paint grilles, registers, diffusers, and similar items exposed in finish spaces. Apply paint by spray method only.
2. Where interior surfaces of air ducts, convector, and baseboard heating cabinets are visible through grilles or louvers, provide coat of flat black paint.
3. Paint interior surfaces of ducts, where visible through registers or grilles, with flat black paint.
4. Paint dampers exposed behind louvers, grilles, convectors, and baseboard cabinets to match face panels.
5. Ductwork exposed in finished spaces.
6. Uninsulated metal piping.
7. Pipe hangers and supports.
8. Tanks that do not have factory-applied final finishes.
9. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
10. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
11. <**Insert other mechanical items to be painted.**>

D. Electrical Work:
1. Panelboards not located in electrical room/closet.
2. Electrical equipment that is indicated to have a factory-primed finish for field painting.
3. Conduit exposed in areas other than utility rooms.
4. <**Insert other electrical items to be painted.**>

3.6 IDENTIFICATION OF FIRE AND SMOKE PROTECTIVE CONSTRUCTION

A. Stencil all fire walls, rated fire barriers, rated smoke barriers, and non-rated smoke partitions, etc. with permanent 2-inch high letters. Identify the names and hour rating of the partition, wall or barrier approximately 8 inches above the ceiling every 12 feet on both sides of these barriers and partitions and at least once in every space. Labels include, but are not limited to, the following:
1. 1-HOUR FIRE BARRIER – FIRESTOP ALL PENETRATIONS.
2. 2-HOUR FIRE BARRIER – FIRESTOP ALL PENETRATIONS.
3. 1-HOUR SMOKE BARRIER – FIRESTOP ALL PENETRATIONS.
4. 2-HOUR SMOKE BARRIER – FIRESTOP ALL PENETRATIONS.
5. 2-HOUR (SHAFTWALL) FIRE BARRIER – FIRESTOP ALL PENETRATIONS.
6. NON-RATED SMOKE PARTITION – SEAL ALL PENETRATIONS.

7. 3-HOUR FIRE WALL – [**PENETRATIONS NOT ALLOWED**] [**FIRESTOP ALL PENETRATIONS**].

B. In spaces without ceilings locate stencil 10 feet minimum above finish floor to bottom of stencil. Stencil must be visible; not hidden behind ductwork, equipment, or other obstacles.

C. Self-adhesive printed signs acceptable to authorities having jurisdiction may be provided instead of painted signs.

3.7 CLEANING AND PROTECTION

A. Remove rubbish, empty cans, rags, and other discarded materials from Project site at end of each work day.

B. Remove paint spills, spatters, and misapplications immediately as they occur.

C. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

F. Provide "Wet Paint" signs to protect newly painted finishes.

3.8 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
1. Institutional Low-Odor/VOC Latex System:
   a. Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
   b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
   c. Topcoat: Institutional low-odor/VOC interior latex (eggshell).

B. Gypsum Board Substrates (paint finish):
1. Institutional Low-Odor/VOC Latex System:
   a. Prime Coat for Paper-Faced Gypsum Board: Interior latex primer/sealer.
   b. Prime Coat for Glass-Mat-Faced Gypsum Board: High solids primer in 2 coats.
   c. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
   d. Topcoat: Institutional low-odor/VOC interior latex flat.
2. High-Performance Architectural Latex System:
   a. Prime Coat for Paper-Faced Gypsum Board: Interior latex primer/sealer.
   b. Prime Coat for Glass-Mat-Faced Gypsum Board: High solids primer in 2 coats.
   c. Intermediate Coat: High-performance architectural latex matching topcoat.
   d. Topcoat: High-performance architectural latex (semigloss).
3. Water-Based Epoxy Coating System:
   a. Prime Coat for Paper-Faced Gypsum Board: Interior latex primer/sealer.
   b. Prime Coat for Glass-Mat-Faced Gypsum Board: High solids primer in 2 coats.

c. Intermediate Coat: Water-based epoxy (interior and exterior).
d. Topcoat: Water-based epoxy (interior and exterior).

C. Cotton or Canvas insulation-Covering Substrates: Including pipe and duct coverings.

D. Exposed Pipes: Paint exposed piping for identification in addition to labels required in other Sections as follows:

E. Natural Gas Piping: Safety Purple (ANSI Z535 Color Chart); Sherwin Williams No. 6981, Passionate Purple.

F. Propane Piping: Safety Red (ANSI Z535 Color Chart); Sherwin Williams No. 4081, Safety Red.

G. Fuel Oil Piping: Safety Brown (ANSI Z535 Color Chart); Sherwin Williams No. 4001, Bolt Brown.

H. Steam Piping: Safety Orange (ANSI Z535 Color Chart); Sherwin Williams No. 4083, Safety Orange.

I. Standpipe and Sprinkler Piping: Red; Sherwin Williams No. 6866, Heartthrob.

J. Steam Condensate Piping: Light Orange; Sherwin Williams No. 6345, Sumptuous Peach.

K. Chilled Water Piping: Pale Green; Sherwin Williams No. 6189, Opaline.

L. Condensor Water Piping: Blue-Green; Sherwin Williams No. 6502, Loch Blue.

M. Heating Hot Water Piping: Pink; Sherwin Williams No. 6303, Rose Colored.

N. Domestic Cold Water Piping: Dark Blue; Sherwin Williams No. 6244, Naval.

O. Domestic Hot Water Piping: Rose Red; Sherwin Williams No. 6863, Lusty Red.

END OF SECTION

PREPARED BY:	
CHECKED BY:	

ISSUED	**DATE**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of wood finishes on the following substrates:
   1. Interior Substrates:
      a. Dressed lumber (finish carpentry).

B. Related Sections include the following:
   1. Division 09 Section "Exterior Painting" for surface preparation and application of standard paint systems on exterior substrates.
   2. Division 09 Section "Interior Painting" for surface preparation and application of standard paint systems on interior substrates.
   3. Division 09 painting Sections for special-use coatings.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.
   1. Submit Samples on representative samples of actual wood substrates, 8 inches (200 mm) square.
   2. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.4 PROJECT CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

B. Stain Colors: Match Architect's samples.

2.2 WOOD FILLERS

A. Wood Filler Paste: Solvent based, high solids filler for new open grained or damaged woods. Capable of filling pores of hardwoods with minimal surface residue and without cracking or shrinkage.
   1. Benjamin Moore; Wood Grain Filler No. 238.
   2. Coronado Paint; None required.
   3. Duron; None required.
   4. ICI Paints; None required.
   5. PPG; None required.
   6. Sherwin-Williams; Sher-Wood Natural Wood Filler No. D70T1.

2.3 PRIMERS AND SEALERS

A. Alkyd Sanding Sealer: Solvent based, quick drying, clear, sandable alkyd sealer for alkyd varnish topcoat.
   1. Benjamin Moore; Quick Dry Sanding Sealer No. 413.
   2. Coronado Paint; Dual Seal Sanding Sealer No. 81-10.
   3. Duron; Interior Sanding Wood Sealer No. 15-014.
   4. ICI Paints; Interior QD Sanding Sealer No. 1916.
   5. M.A.B. Paints; Minit Dri Sanding Sealer No. 037-005.
   6. PPG; Fast Dry Sanding Sealer No. 671.
   7. Sherwin-Williams; Fast Dry Sanding Sealer No. B26V43.

2.4 STAINS

A. Interior Wood Stain (Semitransparent): Solvent based, oil or oil/alkyd, semi transparent, pigmented stain for clear varnish topcoat.
   1. Benjamin Moore; Interior Penetrating Stain No. C234.
   2. Coronado Paint; Penetrating Oil Stain No. 69 Line.
   3. Duron; Interior Penetrating Oil Wood Stain No. 28-100.
   4. ICI Paints; Interior Semi-Transparent Wood Stain No. 1700.
   5. M.A.B. Paints; Deck and Siding Finish No. 049-143.
   6. PPG; Interior Wood Stain Semi-Transparent No. 77-560.
   7. Sherwin-Williams; Interior Oil Stain No. A49V200.

2.5 VARNISHES

A. Interior Varnish (Semigloss): Solvent based, alkyd type, clear varnish.
   1. Benjamin Moore; Benwood Satin Finish Varnish No. C404-00.
   2. PPG; Interior Varnish Semi-Gloss No. 77-7.
   3. Sherwin-Williams; Fast Dry Varnish - Satin No. A66F390.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
   1. Maximum Moisture Content of Wood Substrates: 15 percent when measured with an electronic moisture meter.
   2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes.
   3. Begin finish application only after unsatisfactory conditions have been corrected and surfaces are dry.
   4. Beginning application of finish system constitutes Contractor's acceptance of substrate and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be finished. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
   1. After completing finishing operations, reinstall items that were removed; use workers skilled in the trades involved. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Remove surface dirt, oil, or grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
   2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
   3. Countersink steel nails, if used, and fill with putty tinted to final color to eliminate rust leach stains.

D. Apply wood filler paste to open-grain woods to produce smooth, glasslike finish.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions.
   1. Use applicators and techniques suited for finish and substrate indicated.
   2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Finish Carpentry Substrates:
   1. Alkyd Varnish Over Stain and Sealer System:
      a. Stain Coat: Interior wood stain (semitransparent).
      b. Seal Coat: Alkyd sanding sealer.
      c. Two Finish Coats: Interior varnish (semigloss).

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Curtain tracks and carriers.

B. Related Requirements:
   1. Division 06 Section "Miscellaneous Rough Carpentry" for supplementary wood framing and blocking for mounting items requiring anchorage.
   2. Division 09 Section "Non-Structural Metal Framing" for supplementary metal framing and blocking for mounting items requiring anchorage.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data for each type of track.

B. Shop Drawings:
   1. Show layout and types of cubicles, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
   2. Include details on support and blocking above ceiling.
   3. Clearly indicate that method of securing track is in compliance with code requirements for seismic areas.

C. Samples for Verification: For each type of product required, prepared on Samples of size indicated below:
   1. Curtain Track: Not less than 10 inches (254 mm) long.
   2. Curtain Carrier: Full-size unit.

D. Curtain Track Schedule: Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members to which suspension systems will be attached.
   3. Items penetrating finished ceiling, including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.

e. Access panels.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below**,** before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic: For work in seismic areas comply with state and local codes.

2.2 CURTAIN SUPPORT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. C/S General Cubicle.
   2. Imperial Fastener Company, Inc.
   3. InPro Corporation.

B. Extruded-Aluminum Curtain Track: Not less than 1-1/4 inches wide by 3/4 inch high (32 mm wide by 19 mm high) minimum wall thickness of 0.062 inch (1.57 mm).
   1. Curved Track: Factory-fabricated 12-inch- (305-mm) radius bends.
   2. Finish: Satin anodized.

C. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
   1. End Stop: Nonremovable.

D. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel hook.

E. Exposed Fasteners: Stainless steel.

F. Concealed Fasteners: Hot-dip galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.

B. Up to 20 feet (6.0 m) in length, provide track fabricated from single, continuous length.
1. Curtain Track Mounting: Surface.

C. Surface Track Mounting: Fasten surface-mounted tracks to ceilings at intervals of not less than 24 inches (610 mm). Fasten tracks to structure at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
1. Mechanically fasten to furring through suspended ceiling with screw and tube spacer.

D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
1. Provide one hinged loading unit for each bed.

E. Curtain Carriers: Provide curtain carriers adequate for 4-inch (152-mm) spacing along full length of curtain plus an additional carrier.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Corner Guards.

B. Related Sections:
   1. Section 08 7100: metal armor, kick, mop, and push plates for doors and frames.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

C. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Corner Guards: 12 inches (300 mm) long.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

B. Manufacturer warranties.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- (1.2-m-) long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

D. Regulatory Requirements: Comply with applicable provisions in Florida Accessibility Code for Building Construction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with applicable requirements of Section 01 6000.

B. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
   2. Keep plastic sheet material out of direct sunlight.
   3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
      a. Store corner-guard covers in a vertical position.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.8 MANUFACTURER WARRANTIES

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of plastic and other materials beyond normal use.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded material, thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested per ASTM D 543.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.

C. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.

D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards CG-1: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
1. Basis-of-Design Product: Construction Specialties, Inc.; SM-20/SM-20M Acrovyn Corner Guard or comparable product by one of the following:
   a. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   b. Korogard Wall Protection Systems; a division of RJF International Corporation.
2. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness; as follows:
   a. Profile: Nominal 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius.
   b. Height: 8 feet (2.4 m).
   c. Color and Texture: As selected by Architect from manufacturer's full range.
3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.3 END-WALL GUARDS

A. Surface-Mounted, Resilient, Plastic End-Wall Guard CG-2: Assembly consisting of snap-on plastic cover installed over continuous retainer at each corner, with end of wall covered by semirigid, impact-resistant sheet wall covering; including mounting hardware.
1. Basis-of-Design Product: Construction Specialties, Inc.; SM-20E Acrovyn Corner Guard or comparable product by one of the following:
   a. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   b. Korogard Wall Protection Systems; a division of RJF International Corporation.
2. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness; as follows:
   a. Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius.

b. Height: 8 feet (2.4 m).
c. Color and Texture: As selected by Architect from manufacturer's full range.

3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Preform curved semirigid, impact-resistant sheet wall covering in factory for radius and sheet thickness as follows:
1. Sheet Thickness of 0.040 Inch (1.0 mm): 24-inch (610-mm) radius.
2. Sheet Thickness of 0.060 Inch (1.5 mm): 36-inch (914-mm) radius.

C. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

D. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

E. Miter corners and ends of wood handrails for returns.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:
      a. Corner Guards and End Guards: Above wall base.
   2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
      a. Provide anchoring devices to withstand imposed loads.
      b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
      c. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Toilet and bath accessories.
   2. Healthcare accessories.
   3. Childcare accessories.
   4. Under-lavatory guards.
   5. Custodial accessories.

B. Owner-Furnished/Contractor Installed Material: A2 Toilet Tissue Dispenser, B1 Paper Towel Dispenser, J1 Liquid-Soap Dispenser.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.
   6. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

B. Manufacturer warranties.

1.4 QUALITY ASSURANCE

A. Safety Glazing Products: For tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.5 DELIVERY, STORAGE, HANDLING

A. Comply with applicable requirements of Section 01 6000.

1.6 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 TOILET AND BATH ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.
   4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Toilet Tissue (Roll) Dispenser A2:
   1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-2888.
   2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset. Spare roll drops into place after bottom roll is emptied.
   3. Mounting: Surface mounted.
   4. Operation: Noncontrol delivery with theft-resistant spindle.
   5. Capacity: Designed for 5-1/4 inch (133 mm) diameter tissue rolls.
   6. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Paper Towel (Folded) Dispenser B1:
   1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-4262.
   2. Mounting: Surface mounted.
   3. Minimum Capacity: 400 C-fold or 525 multifold towels.
   4. Material and Finish: Stainless steel, No. 4 finish (satin).
   5. Lockset: Tumbler type.
   6. Refill Indicators: Pierced slots at sides or front.

D. Wall Shelf G1:
   1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-298.
   2. Description: With exposed edges turned down not less than 1/2 inch (12.7 mm) and supported by two triangular brackets welded to shelf underside.
   3. Size: 8 inches (203 mm) deep by length indicated on Drawings or in schedule.
   4. Material and Finish: Not less than nominal 0.05-inch (1.3-mm) thick stainless steel, No. 4 finish (satin).

E. Mirror Unit without shelf H2:
   1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-290.
   2. Frame: Stainless-steel angle, 0.05 inch (1.3 mm) thick.
      a. Corners: Welded and ground smooth.
   3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
      a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
   4. Size: As indicated on Drawings or in Schedule.

F. Mirror Unit custom shelf H3:
   1. Basis-of-Design Product: Aesthetic Mirror Co.
   2. Frame: As indicated on Drawings.
   3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
      a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
   4. Size: As indicated on Drawings.

G. Liquid-Soap Dispenser J1:
   1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-2012.
   2. Description: Automatic soap dispenser.
   3. Mounting: Wall mounted.
   4. Capacity: 30 oz.
   5. Materials:

6. Stainless steel, satin finish.
7. Operation: 360 degree rotating spout. Piston and supply tube assembly removable from top for filling.

H. Robe Hook K1:
1. Basis-of-Design Product: Amerock; Arrondi SKU #BH2654255.
2. Description: Single-prong unit.
3. Material and Finish: Stainless steel.
4. Mounting: Concealed wall plate.

I. Grab Bar Q5:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-6806x36.
2. Mounting: Flanges with concealed fasteners. Horizontal mount.
3. For toilet partition mounting provide Bobrick Anchor No. 2583, for each flange.
4. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
   a. Finish: Smooth, No. 4, satin finish.
5. Outside Diameter: 1-1/2 inches (38 mm).
6. Configuration and Length: Straight, 36 inches (914 mm) long.

J. Grab Bar Q7:
1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-6806x42.
2. Mounting: Flanges with concealed fasteners. Horizontal mount.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
   a. Finish: Smooth, No. 4, satin finish.
4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: Straight, 42 inches (1067 mm) long.

2.3 CHILDCARE ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
1. American Specialties, Inc.
2. Brocar Products, Inc.
3. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
4. Koala Kare Products; a division of Bobrick Washroom Equipment, Inc.

B. Diaper-Changing Station U2:
1. Basis-of-Design Product: Koala Kare Products, a Division of Bobrick; KB100-00.
2. Description: Molded HDPE horizontal unit that opens by folding down from stored position and with child-protection strap.
   a. Engineered to support a minimum of 250-lb (113-kg) static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: High-density polyethylene in manufacturer's standard color.
6. Liner Dispenser: Built in.

2.4 UNDERLAVATORY GUARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Plumberex Specialty Products, Inc.
   2. TCI Products.
   3. Truebro, Inc.

B. Underlavatory Guard V1:
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded-plastic, white.

2.5 HEALTHCARE ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.
   4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Specimen Pass-Through Cabinet S1:
   1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-505.
   2. Description: With self-closing doors on both sides, lock that prevents doors from both being opened at the same time, and removable stainless-steel tray.
   3. Nominal Wall Opening: 11-1/2 inches (292 mm) by 10-7/8 inches (276 mm) width by height.
   4. Material and Finish: Stainless steel, No. 4 finish (satin).

2.6 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. American Specialties, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Bradley Corporation.
   4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Mop and Broom Holder W1:
   1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc; B-223.
   2. Description: Unit with holders to keep brooms and mops away from wall.
   3. Length: 36 inches (914 mm).
   4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
   5. Material and Finish: Stainless steel, No. 4 finish (satin).

2.7 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
   1. Provide galvanized steel backing sheet, not less than 0.034 inch (0.85 mm) and full mirror size, with non-absorbent filler material. Corrugated cardboard is not an acceptable filler material.

C. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that concealed supports were installed correctly.

3.2 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer.

C. Install units level, plumb, and rigidly and firmly anchored to wall structure.

D. Confirm attachment (mechanical or adhesive) and reinforcement requirements of all accessories, including Owner-Furnished/Contractor-Installed (OF/CI) and Owner Furnished/Owner Installed (OF/OI).

E. Grab Bars and Folding Shower Seats: Install to withstand downward load of at least 500 lbf (2224 N), when tested according to method in ASTM F 446.

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.4 ACCESSORIES SCHEDULE AND NOTES

A. Schedule: According to the type of space indicated in schedule provide the indicated set of toilet and related accessories for each space. Refer to Drawings to determine the number and

location of each type space referred to in schedule so that the correct quantity of each accessory is provided.

1. ACCESSIBLE (UNISEX) STAFF TOILET (WITH ONE WATER CLOSET AND ONE LAVATORY):

   One each (unless otherwise noted): A2, B1, H3, J1, K1 (on door), Q5, Q7.

2. ACCESSIBLE (UNISEX) PATIENT TOILET (WITH ONE WATER CLOSET AND ONE LAVATORY):

   One each (unless otherwise noted): A2, B1, H3, J1, K1 (on door), Q5, Q7.

3. ACCESSIBLE (UNISEX) PUBLIC TOILET (WITH ONE WATER CLOSET AND ONE LAVATORY):

   One each (unless otherwise noted): A2, B1, H3, J1, K1 (on door), Q5, Q7, U2.

4. ACCESSIBLE (INDIVIDUAL USE) DRESSING CUBICLE OR ROOM:

   One each (unless otherwise noted): H2 (custom, 18 inches wide by 60 inches tall), two K1 (See ADA Section 4.35).

5. NON-ACCESSIBLE (INDIVIDUAL USE) DRESSING CUBICLE OR ROOM:

   One each (unless otherwise noted): H2 (custom, 18 inches wide by 60 inches tall), two K1.

6. STAFF LOUNGE/LOCKER ROOM OR STAFF LOCKER ROOM:

   One each (unless otherwise noted): B1 and J1 at each sink, H2 (custom, 18 inches wide by 60 inches tall) shall be located by the Architect if not indicated in the drawings.

7. JANITOR'S CLOSET:

   One each (unless otherwise noted): B1, W1, J1.

8. OFFICE:

   One each (unless otherwise noted): K1.

9. EXAM ROOM OR TREATMENT ROOM:

   One each (unless otherwise noted): B1 and J1 at each sink, K1 on wall behind door.

10. OTHER SPACES:

Where a hand washing lavatory or sink is indicated on the floor plan, in spaces in other than those already indicated above or below, provide one B1 and one J1 at each lavatory/sink.

B. Notes for Accessories:

1. Mounting heights above finish floor (A.F.F.) to top, bottom or centerline (CL) of accessory shall be as follows unless otherwise noted. Comply with 2012 Florida Accessibility Code for Building Construction.
2. See Interior Elevations on Sheets A5.2 - A5.6 in the Drawings for additional mounting heights and locations for toilet and related accessories which are not indicated herein. (NOTE: The toilet accessories must be mounted to comply with the most stringent requirements of the applicable state and local accessibility codes and of the Americans with Disabilities Act.)
3. Verify that recessed type toilet accessories are not recessed in rated fire barriers, in rated smoke barriers or in partitions with a required STC rating. Calk all recessed type toilet accessories to non-rated partitions and seal smoke tight as required by code.
4. If the International Building Code (IBC), Florida Building Code (FBC), North Carolina Building Code (NCBC), or any Building Code based on the IBC applies to this Project, install and seal all toilet accessories continuously to the walls to protect structural elements from moisture. See Section 1210.2 of the IBC and IBC-based codes.
5. Install Owner furnished accessories to comply with the requirements of governing accessibility codes and ADA. Coordinate with the Architect for exact locations if not shown on the drawings. All Owner furnished toilet accessories must be installed prior to the final state inspection.
6. Locate mop and broom holders in janitor closets so that wet mop will drip into the janitor sink.
7. Coordinate with Architect to field locate toilet accessories not located on the drawings.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portable fire extinguishers and mounting brackets for wall-hung fire extinguishers.
   2. Fire protection cabinets for the following:
      a. Portable fire extinguishers.
   3. Fire protection accessories.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
   1. Fire Extinguishers: Include rating, classification, dimensions, and finish information.
   2. Fire Protection Cabinets: Include roughing-in dimensions, mounting details, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, panel style, and finish information.

C. Samples for Verification: Each required cabinet finish; prepared on minimum 6- by 6-inch (150 by 150 mm) pieces of required base metal.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers and cabinets to include in maintenance manuals.

B. Manufacturer warranties.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Provide fire protection cabinets sized to accommodate required fire extinguishers. If indicated cabinet size is too small, provide larger standard manufactured size and note size change in submittals.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

C. Minor variations in size from dimensions indicated that are needed to utilize standard manufactured fire protection cabinets will be acceptable, but note such dimensions in submittals.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CABINET MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
   1. Sheet: ASTM B 209 (ASTM B 209M).
   2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

C. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 6 mm thick, with Finish 1 (smooth or polished).

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amerex Corporation (fire extinguishers only).
   2. Badger Fire Protection (fire extinguishers only).
   3. J.L. Industries, Inc.
   4. Larsen's Manufacturing Company.
   5. Potter-Roemer; Div. of Smith Industries, Inc.

2.3 FIRE PROTECTION EQUIPMENT

A. The following list uses standardized alphanumeric designations for fire protection equipment. The numbering sequence may have missing numbers for types of products that are not required for this Project.

B. FP-9: 10 LB. ABC, WALL HUNG FIRE EXTINGUISHER (FE)
   1. Larsen’s number 2409-R2, 10 pound ABC multi-purpose dry chemical, wall hung fire extinguisher with UL rating of 4A:80B:C.
   2. Furnish complete with wall mounting bracket.

C. FP-13: FEC WITH 10 LB. ABC EXTINGUISHER
   1. Cabinet Type: Recessed with exposed flat trim sized to accommodate fire extinguisher.

a. Cabinet Material: Steel.
b. Cabinet Trim Material: Same material and finish as door.
c. Door Material: Steel sheet.
d. Door Style: Horizontal duo panel with frame.
    1) Glazing: Acrylic sheet.
        a) Acrylic Sheet Color: Clear transparent acrylic sheet.
    2) Hardware: Projecting door pull and friction latch; continuous hinge, of same material and finish as trim permitting door to open 180 degrees.
e. Label/Lettering: Pressure-sensitive label with red letters; vertical orientation applied to door. Text shall read “Fire Extinguisher.”

2. One Larsen’s number 2409-R2, 10 pound ABC multi-purpose dry chemical fire extinguisher, with UL rating of 4A:80B:C.

2.4 MOUNTING BRACKETS

A. Description: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or black baked-enamel finish.
    1. Provide brackets for extinguishers not located in cabinets.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location..
    1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

2.5 FIRE PROTECTION CABINETS

A. Non-rated Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
    1. Weld joints and grind smooth.
    2. Provide factory-drilled mounting holes.

B. Cabinet Doors:
    1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
    2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
    1. Maximum Trim Projection: 5/16 inch.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
   1. Color and Gloss: Selected by Architect from manufacturer’s standard line.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and support locations.

C. Verify that concealed framing supports are correctly positioned for surface mounted cabinets and mounting brackets.

D. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets and fire extinguishers in locations and at mounting heights indicated on Drawings. If mounting heights are not indicated obtain from Architect.
   1. Comply with ADA Guidelines’ “reach range” dimensions for maximum mounting heights of cabinets and extinguishers.

B. Fasten fixed components rigidly and securely to supporting construction.

C. Fire Protection Cabinets: Install level, plumb, and parallel to plane of wall.

D. Wall Mounted Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

E. Identification: Except cabinets with factory-applied identification, provide labels on cabinets and wall surfaces at mounting brackets as required by authorities having jurisdiction.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, after fire protection cabinets are installed and construction is complete.

B. Adjust fire protection cabinet doors to operate easily without binding.

C. On completion of fire protection cabinet installation and all other construction in the vicinity of the cabinet, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Pre-engineered, manufactured aluminum canopy systems.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 03 Section "Cast-in-Place Concrete" for concrete foundation/footing requirements.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and finishes.

C. Shop drawings clearly indicating:
   1. Overall dimensions and clearances required.
   2. Structural design loads.
   3. Installation and connection details.
   4. Materials and finishes.

D. Submit manufacturer's current Florida Product Approval Notice indicating product's acceptance for use in accordance with FBC. Notice of Approval shall indicate as minimum, product control number, expiration date of approval and the specific conditions and details governing the approval.

E. Samples for Initial Selection: For factory-applied color finishes.

F. Samples for Verification: 6 by 6 inch sample with factory-applied color finish, for each color indicated.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain canopy system from one source and by a single manufacturer.

B. Erection shall be performed by the manufacturer or his approved installer.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum canopies capable of complying with performance requirements indicated.

B. Structural Performance: Provide aluminum canopies capable of withstanding the following, including wind loads, at basic wind speed indicated.
   1. Design Pressure (Wind Load Requirements): Meet the design positive and negative design (wind load) pressures as indicated on the drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. E.L. Burns Company, Inc., www.burnscovers.com
   2. Texas Aluminum Industries
   3. Royal Aluminum
   4. Perfection Architectural Systems.
   5. Dittmer Architectural Aluminum.
   6. Peachtree Protective Covers, Inc.

2.2 MATERIALS, GENERAL

A. Aluminum: Extruded aluminum alloy 6063, heat treated to T6 temper.
   1. Deck Profile: Ribbed
   2. Finishes:
      a. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018mm or thicker) complying with AAMA 607.1.
      b. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018mm or thicker) complying with AAMA 606.1 or AAMA 608.1.

2.3 FABRICATION

A. Framing Sections: Welded into 1-piece rigid bents or built as mechanical joints in the manufacturer's shop. Pre-assemble canopies to the extent possible.

B. Design canopy system for wind load requirements indicated.

C. Provide roof deck sections which interlock in a homogeneous structural unit, with joints designed and fabricated into a structurally rigid shape which is self-flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surrounding conditions to verify they are acceptable for installation of canopy system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions and approved shop drawings. Coordinate with installation of canopy system with adjacent systems, as required to ensure that each element of the work performs properly.

1. Install vertical and horizontal members to be plumb and level.

B. Isolation: Where metal surfaces of units contact dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces or provide other permanent separation as recommended by aluminum producer.

C. Expansion Provisions: Install running lengths to allow controlled expansion for movement of metal components in relation not only to one another but also to adjoining dissimilar materials, in a manner sufficient to prevent water leakage, deformation, or damage.

3.3 CLEANING AND PROTECTING

A. Clean exposed metal surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

B. Protection: Provide protective measures as required to ensure work of this section will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Countertops clad with high pressure decorative laminate.
   2. Manufactured support brackets for countertops.

B. As used in this Section and on Drawings, the terms “plastic laminate” and “high pressure decorative laminate” are synonymous.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
   1. Panel products.
   2. Manufactured support brackets.
   3. Fire-retardant-treated materials; include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of cutouts and holes for plumbing fixtures faucets and other items installed in plastic-laminate countertops.
   2. Show edge and backsplash profiles and methods of joining.
   3. Show supports, including anchorage of manufactured brackets.
   4. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material and profile applied to one edge.
   2. Wood-grain plastic laminates, 12 by 24 inches (300 by 600 mm), for each type, pattern and surface finish, with one sample applied to core material and specified edge material and profile applied to one edge.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops 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.

B. Environmental Limitations: Do not deliver or install countertops 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.

C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

B. Grade: Custom unless noted otherwise below:
   1. Premium at Reception Desk.

C. Regional Materials: Plastic-laminate countertops shall be manufactured within 500 miles (800 km) of Project site.

D. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Formica Corporation.
      b. Panolam Industries International, Inc.
      c. Wilsonart International; Div. of Premark International, Inc.

E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As indicated by manufacturer's designations.
   2. Grain Direction: As indicated on Drawing D0.1 and Interior Elevations..

F. Edge Treatment: As indicated.

G. Core Material: Medium-density fiberboard.

H. Core Material at Sinks: exterior-grade plywood.

I. Core Thickness: 3/4 inch (19 mm).
   1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.

J. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

K. Backer Sheet: Provide paper backing on underside of countertop substrate.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
   2. Softwood Plywood: DOC PS 1.

2.3 ACCESSORIES

A. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, color as selected by Architect, molded-plastic grommets and matching plastic caps with slot for wire passage.
   1. Product: Subject to compliance with requirements, provide " SG flip-top series" by Doug Mockett & Company, Inc.

B. Trash Hole Trim: 6-3/4 inch O.D. by 6 inches deep.

1. Product: Subject to compliance with requirements provide product by Doug Mockett and Company, Inc., as follows: TM1A-SSS, satin stainless steel.

C. Manufactured Countertop Brackets: Provide T.I.G. welded structural aluminum supports meeting ADA requirements and as detailed.
   1. Rangine Corporation; RAKKS Counter Support Bracket, model No. EH-1824, customized to support sloped panel below countertop, surface mounted. Finish: Powder-coated in standard color selected by Architect.
   2. Rangine Corporation; RAKKS Counter Support Bracket, model No. EH-1818, surface mounted. Finish: Factory-primed for site painting.

2.4 MISCELLANEOUS MATERIALS

A. Adhesives: Do not use adhesives that contain urea formaldehyde.

B. 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.
   4. Architectural Sealants: 250 g/L.

2.5 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:
   1. Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.

C. Complete fabrication, including assembly, 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.
   1. Seal edges of openings in countertops with coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
   1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
   2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
   1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
   3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid surfacing material countertops and backsplashes.
   2. Quartz agglomerate countertops.
   3. Manufactured countertop brackets.

B. Related Sections:
   1. Division 22: Sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Prepare submittals per requirements of Section 01 3300 – Submittal Procedures.

B. Product Data:
   1. Countertop materials and sinks.
   2. Manufactured countertop brackets.

C. Shop Drawings:
   1. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   2. Show supports, including anchorage of manufactured brackets.

D. Samples for Verification: For the following products:
   1. Countertop material, 6 inches (150 mm) square.
   2. One solid-surface-material countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.
   3. One full-size quartz agglomerate countertop, with front edge, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.4 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Install integral sink bowls in countertops in the shop.

2.2 QUARTZ AGGLOMERATE COUNTERTOPS

A. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

2.3 COUNTERTOP MATERIALS

A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

B. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Avonite Surfaces.
      b. E. I. du Pont de Nemours and Company.
      c. Formica Corporation.
      d. LG Chemical, Ltd.
      e. Meganite Inc.
      f. Samsung Chemical USA, Inc.
      g. Swan Corporation (The).
      h. Transolid, Inc.
      i. Wilsonart International.
   2. Type: Provide Standard Type or Veneer Type made from material complying with requirements for Standard Type, as indicated unless Special Purpose Type is indicated.
   3. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
   4. Colors and Patterns: As indicated by manufacturer's designations.

C. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cambria.
      b. Cosentino USA.
      c. E. I. du Pont de Nemours and Company.
      d. LG Chemical, Ltd.
      e. Meganite Inc.
      f. Samsung Chemical USA, Inc.
      g. Technistone USA, Inc.
      h. Transolid, Inc.
   2. Colors and Patterns: As indicated by manufacturer's designations.

2.4 ACCESSORIES

A. Manufactured Countertop Brackets: Provide welded structural aluminum supports meeting ADA requirements and as detailed.
   1. Rangine Corporation; RAKKS Counter Support Bracket, model No. EH-1824, customized to support sloped panel below countertop, surface mounted. Finish: Powder-coated in standard color selected by Architect.
   2. Rangine Corporation; RAKKS Counter Support Bracket, model No. EH-1818, surface mounted. Finish: Factory-primed for site painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with applicable requirements of Section 01 7300.

B. Install countertops level to tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).

C. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Drill holes for screws as recommended by manufacturer.

D. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions.

E. Dress joints smooth, remove surface scratches, and clean entire surface.

F. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

G. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Lead sheet, strip, and plate.
   2. Borated polyethylene.
   3. Lead-lined building materials and products including the following:
      a. Concrete masonry units.
      b. Gypsum board.
   4. Informational signs.

B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for steel framing members for bracing lead-brick wall shielding.
   2. Division 08 Section "Radiation Shielding Doors and Frames" for lead-lined steel doors, door frames, and window frames.
   3. Division 09 Section “Gypsum Board” for finishing materials, accessories, and trim applied to lead-lined gypsum board.

1.2 DEFINITIONS

A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.

1.3 PERFORMANCE REQUIREMENTS

A. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.
   1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by the Architect’s radiation health physicist. This design is available to Contractor on request.

B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.
   1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Qualification Data: For qualified Installer and manufacturer.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of radiation protection product from single source and from single 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 application.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to radiation protection including, but not limited to, the following:
      a. Sequence and schedule of radiation protection work in relation to other work.
      b. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
      c. Methods of attaching other construction and equipment to lead-lined finishes.
      d. Notification procedures for work that requires modifying radiation protection.
      e. Requirements for field quality control.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver materials in original packages, containers, or bundles bearing the 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.

C. Lead-Lined Gypsum Panels: Neatly stack panels flat to prevent deformation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install radiation protection until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lead Sheet, Strip, and Plate: ASTM B 749, alloy UNS No. L51121 (chemical-copper lead).

B. Borated Polyethylene: Manufactured specifically for neutron shielding and containing not less than 5 percent boron.

C. Lead Bricks: Solid lead complying with Federal Specification QQL-201 F Grade C. Smooth face, size 2-1/2 by 4 by 12 inches.

D. Lead Glass: Lead-barium, polished float glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Amerope Enterprises, Inc.
      b. McGrory Glass, Inc.
      c. Schott North America, Inc.

   2. Safety Glass: Laminated float glass.
      a. Outer Lite: Clear float glass; 1/4 inch thick.
      b. Interlayer: Clear polyvinyl butyral or cured resin of manufacturer's standard thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
      c. Inner Lite: Lead-barium, polished float glass; 1/4 inch thick.

E. Lead-Lined Gypsum Board: 5/8 inch (15.9 mm), Type “X,” thick gypsum board complying with Division 09 Section “Gypsum Board” of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.
   1. Provide lead sheet lining the full width of board and length necessary to extend from floor to 84 inches (2133 mm) above floor.
   2. Provide 3-inch (75-mm-) wide lead strips for wrapping metal stud flanges.
   3. Provide 2-inch (50-mm-) wide lead strips for backing joints.
   4. Provide 5/8 inch (16 mm) lead disks for covering screw heads.

F. Accessories and Fasteners: Provide manufacturer’s standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.

2.2 INFORMATIONAL SIGNS

A. Informational Signs, General: Fabricate signs by engraving lettering in high-pressure-laminate engraving stock with contrasting face and core. Machine engrave copy using high-speed cutters mechanically positioned by master templates for accurately formed letters, numbers, and symbols.
   1. Color: As selected by Architect from manufacturer's full range of colors.
   2. Provide copy indicated or as directed. Provide signs of sufficient size to contain required information.
   3. Indicate lead equivalence in millimeters and heights of radiation protection in inches (millimeters).

B. Rooms Where the Level of Protection Is Uniform Throughout: Provide one sign for each room indicating lead equivalence of partitions, ceilings, floors, doors, and other portions of radiation protection enclosure. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LEAD-LINED GYPSUM BOARD

A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.

B. Fastening to Metal Supports (Non-Rated Partition): Use steel drill screws spaced as recommended in writing by gypsum board manufacturer. Install lead strips covering face of framing and wrap around flange to cover points of screws. Provide shims at intermediate supports.
   1. Where possible, install lead-lined gypsum board before installing gypsum board on other side of partition, and do not fold lead strips back over inside of flange until after lead-lined gypsum board is applied.
   2. Apply lead disks recessed flush with surface of board over heads of screws securing trim.

C. Fastening to Metal Supports (Non-Rated Partitions): Use steel drill screws spaced as recommended in writing by gypsum board manufacturer. Apply lead disks over screw heads and recess flush with surface of board.
   1. Install lead strips, 2 inches (50 mm) wide minimum and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at intermediate supports.
   2. Apply lead disks recessed flush with surface of board over heads of screws securing trim.

D. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least 1 inch (25 mm). Arrange board around openings so neither horizontal nor vertical joints occur at corners of openings.

3.3 INSTALLATION OF PENETRATING ITEMS

A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.

B. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.

C. Secure shields at penetrations using adhesive or wire ties, but not penetrating fasteners, unless indicated on Drawings.

D. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch (25 mm). Wrap conduit with lead sheet for a distance of not less than 10 inches (250 mm) from box.

E. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three times the largest opening dimension. Lap lead sheet with adjacent lead lining at least 1 inch (25 mm).

F. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 inches (250 mm) from point of penetration.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.

B. Testing: After radiology equipment has been installed and placed in operating condition, have radiation shielding tested by a health physicist who is certified by a nationally recognized agency. Owner will pay for testing. Decision of acceptability of shielding by health physicist shall be binding.

C. Method of Testing: In accordance with requirements of National Bureau of Standards Handbook H-76 "Medical X-Ray Protection up to Three Million Volts".

D. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements, including finishes and other work covering defective work. Do additional testing as required to obtain health physicist's acceptance. Repair, replacement and re-testing shall be at contractor's expense.

3.5 PROTECTION

A. Lock radiation-protected rooms once doors and locks are installed and limit access to only those persons performing work in the rooms.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:

1. Wet-pipe sprinkler systems.

B. Related Sections include the following:

1. Division Division 26 Section "Fire Alarm" for alarm devices not specified in this Section.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).

B. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

a. Building Service Areas: Ordinary Hazard, Group 1.
b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
c. General Storage Areas: Ordinary Hazard, Group 1.
d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
e. Office and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m).
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (9.5 mL/s over 139-sq. m).

4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler:

   a. Office Spaces: 225 sq. ft. (20.9 sq. m).
   b. Storage Areas: 130 sq. ft. (12.1 sq. m).
   c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
   d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:

   a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.

1.6 SUBMITTALS

A. Product Data: For the following:

1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
2. Pipe hangers and supports.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
5. Monitors.
6. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
7. Alarm devices, including electrical data.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Fire-hydrant flow test report.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

F. Welding certificates.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include fabricating and installing fire-suppression systems.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Victaulic Co. of America.

b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD and cement lining.
c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.
d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing with key matching ductile-iron-pipe groove and key

matching steel-pipe groove, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

e. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

2.3 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865.

B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.

a. Manufacturers:

1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Ward Manufacturing.

C. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

D. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Anvil International, Inc.
2) Central Sprinkler Corp.
3) Ductilic, Inc.
4) JDH Pacific, Inc.
5) National Fittings, Inc.
6) Shurjoint Piping Products, Inc.

7) Southwestern Pipe, Inc.
8) Star Pipe Products; Star Fittings Div.
9) Victaulic Co. of America.
10) Ward Manufacturing.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

E. Threaded-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe; with factory- or field-threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865.

F. Plain-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.

a. Manufacturers:

1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Ward Manufacturing.

G. Plain-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

H. Grooved-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe; with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

    a. Manufacturers:

        1) Anvil International, Inc.
        2) Central Sprinkler Corp.
        3) Ductilic, Inc.
        4) JDH Pacific, Inc.
        5) National Fittings, Inc.
        6) Shurjoint Piping Products, Inc.
        7) Southwestern Pipe, Inc.
        8) Star Pipe Products; Star Fittings Div.
        9) Victaulic Co. of America.
        10) Ward Manufacturing.

    b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

    c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

I. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250).

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.

    a. Manufacturers:

        1) Anvil International, Inc.
        2) Victaulic Co. of America.
        3) Ward Manufacturing.

J. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250).

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

K. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250); with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Anvil International, Inc.
2) Central Sprinkler Corp.
3) Ductilic, Inc.
4) JDH Pacific, Inc.
5) National Fittings, Inc.
6) Shurjoint Piping Products, Inc.
7) Southwestern Pipe, Inc.
8) Star Pipe Products; Star Fittings Div.
9) Victaulic Co. of America.
10) Ward Manufacturing.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.4 DIELECTRIC FITTINGS

A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Hart Industries International, Inc.
e. Watts Industries, Inc.; Water Products Div.
f. Zurn Industries, Inc.; Wilkins Div.

C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig (1200-kPa) minimum working-pressure rating as required for piping system.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products and Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig (2070-kPa) working-pressure rating at 225 deg F (107 deg C).

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

F. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig (2070-kPa) working-pressure rating at 225 deg F (107 deg C).

1. Manufacturers:

a. Perfection Corporation.
b. Precision Plumbing Products, Inc.
c. Victaulic Co. of America.

2.5 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

2.6 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 250-psig (1725-kPa) minimum working-pressure rating if fittings are components of high-pressure piping system.

B. Outlet Specialty Fittings:

1. Manufacturers:

a. Anvil International, Inc.
b. Central Sprinkler Corp.

c. Ductilic, Inc.
d. JDH Pacific, Inc.
e. National Fittings, Inc.
f. Shurjoint Piping Products, Inc.
g. Southwestern Pipe, Inc.
h. Star Pipe Products; Star Fittings Div.
i. Victaulic Co. of America.
j. Ward Manufacturing.

2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.

C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Manufacturers:

a. Central Sprinkler Corp.
b. Fire-End and Croker Corp.
c. Viking Corp.
d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Manufacturers:

a. AGF Manufacturing Co.
b. Central Sprinkler Corp.
c. G/J Innovations, Inc.
d. Triple R Specialty of Ajax, Inc.

F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers:

a. CECA, LLC.
b. Merit.

2.7 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig (1200 kPa) minimum pressure rating. Valves shall have 250-psig (1725-kPa) minimum pressure rating if valves are components of high-pressure piping system.

B. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
2. NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
3. NPS 3 (DN 80): Ductile-iron body with grooved ends.

a. NIBCO.
b. Victaulic Co. of America.

C. Butterfly Valves: UL 1091.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) Global Safety Products, Inc.
2) Milwaukee Valve Company.

2. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

1) Central Sprinkler Corp.
2) Global Safety Products, Inc.
3) McWane, Inc.; Kennedy Valve Div.
4) Mueller Company.
5) NIBCO.
6) Pratt, Henry Company.
7) Victaulic Co. of America.

D. Check Valves NPS 2 (DN 50) and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers:

a. AFAC Inc.

b. American Cast Iron Pipe Co.; Waterous Co.
c. Central Sprinkler Corp.
d. Clow Valve Co.
e. Crane Co.; Crane Valve Group; Crane Valves.
f. Crane Co.; Crane Valve Group; Jenkins Valves.
g. Firematic Sprinkler Devices, Inc.
h. Globe Fire Sprinkler Corporation.
i. Grinnell Fire Protection.
j. Hammond Valve.
k. Matco-Norca, Inc.
l. McWane, Inc.; Kennedy Valve Div.
m. Mueller Company.
n. NIBCO.
o. Potter-Roemer; Fire Protection Div.
p. Reliable Automatic Sprinkler Co., Inc.
q. Star Sprinkler Inc.
r. Stockham.
s. United Brass Works, Inc.
t. Venus Fire Protection, Ltd.
u. Victaulic Co. of America.
v. Watts Industries, Inc.; Water Products Div.

E. Gate Valves: UL 262, OS&Y type.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) Crane Co.; Crane Valve Group; Crane Valves.
2) Hammond Valve.
3) NIBCO.
4) United Brass Works, Inc.

2. NPS 2-1/2 (DN 65) and Larger: Cast-iron body with flanged ends.

a. Manufacturers:

1) Clow Valve Co.
2) Crane Co.; Crane Valve Group; Crane Valves.
3) Crane Co.; Crane Valve Group; Jenkins Valves.
4) Hammond Valve.
5) Milwaukee Valve Company.
6) Mueller Company.
7) NIBCO.
8) Red-White Valve Corp.
9) United Brass Works, Inc.

F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch, Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
2. NPS 2 (DN 50) and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Manufacturers:

1) Milwaukee Valve Company.
2) NIBCO.
3) Victaulic Co. of America.

3. NPS 2-1/2 (DN 65) and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

1) Central Sprinkler Corp.
2) Grinnell Fire Protection.
3) McWane, Inc.; Kennedy Valve Div.
4) Milwaukee Valve Company.
5) NIBCO.
6) Victaulic Co. of America.

2.8 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 (DN 50) and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig (4140-kPa) minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.9 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig (1200-kPa) minimum pressure rating. Control valves shall have 250-psig (1725-kPa) minimum pressure rating if valves are components of high-pressure piping system.

1. Manufacturers:

    a. AFAC Inc.
    b. Central Sprinkler Corp.
    c. Firematic Sprinkler Devices, Inc.
    d. Globe Fire Sprinkler Corporation.
    e. Grinnell Fire Protection.
    f. Reliable Automatic Sprinkler Co., Inc.
    g. Star Sprinkler Inc.
    h. Venus Fire Protection, Ltd.
    i. Victaulic Co. of America.
    j. Viking Corp.

B. Automatic Drain Valves: UL 1726, NPS 3/4 (DN 20), ball-check device with threaded ends.

1. Manufacturers:

    a. AFAC Inc.
    b. Grinnell Fire Protection.

2.10 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum pressure rating.

B. Manufacturers:

1. Central Sprinkler Corp.
2. Grinnell Fire Protection.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco.
5. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.11 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers:

1. AFAC Inc.
2. Central Sprinkler Corp.
3. Elkhart Brass Mfg. Co., Inc.
4. Fire-End and Croker Corp.
5. Fire Protection Products, Inc.
6. GMR International Equipment Corporation.
7. Guardian Fire Equipment Incorporated.
8. Potter-Roemer; Fire-Protection Div.
9. Reliable Automatic Sprinkler Co., Inc.
10. United Brass Works, Inc.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig (1200-kPa) minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."

1. Type: Flush, with **two** inlets and square or rectangular escutcheon plate.
2. Type: Exposed, projecting, with two inlets and round escutcheon plate.
3. Finish: Polished chrome-plated, Rough chrome-plated, Polished brass.

2.12 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- (250-mm-) diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 (DN 20) inlet and NPS 1 (DN 25) drain connections.

1. Manufacturers:

    a. AFAC Inc.
    b. Central Sprinkler Corp.
    c. Firematic Sprinkler Devices, Inc.
    d. Globe Fire Sprinkler Corporation.
    e. Grinnell Fire Protection.
    f. Reliable Automatic Sprinkler Co., Inc.
    g. Star Sprinkler Inc.
    h. Viking Corp.

C. Electrically Operated Alarm: UL 464, with 6-inch- (150-mm-) minimum diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

D. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig (1725-kPa) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Manufacturers:

a. ADT Security Services, Inc.
b. Grinnell Fire Protection.
c. ITT McDonnell & Miller.
d. Potter Electric Signal Company.
e. System Sensor.
f. Viking Corp.
g. Watts Industries, Inc.; Water Products Div.

E. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers:

a. McWane, Inc.; Kennedy Valve Div.
b. Potter Electric Signal Company.
c. System Sensor.

2.13 PRESSURE GAGES

A. Manufacturers:

1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Brecco Corporation.
4. Dresser Equipment Group; Instrument Div.
5. Marsh Bellofram.
6. WIKA Instrument Corporation.

B. Description: UL 393, 3-1/2- to 4-1/2-inch- (90- to 115-mm-) diameter, dial pressure gage with range of 0 to 250 psig (0 to 1725 kPa) minimum.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
2. Air System Piping: Include retard feature and caption "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Report results to Architect/Engineer.

B. Report test results promptly and in writing.

3.2 EARTHWORK

A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 EXAMINATION

A. Examine roughing-in for hose connections to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, and other conditions where hose connections are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

C. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

D. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints. Include corrosion-protective encasement.

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig (1200-kPa) Maximum Working Pressure:

1. NPS 2 (DN 50) and Smaller: Threaded-end, black, schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
2. NPS 2-1/2 to NPS 4 (DN 60 to DN 100): Grooved-end, black, schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.6 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.

    a. Shutoff Duty: Use ball, butterfly, or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.

    a. Shutoff Duty: Use ball, butterfly, or gate valves.
    b. Throttling Duty: Use ball or globe valves.

3.7 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Twist-Locked Joints: Insert plain-end piping into locking-lug fitting and rotate retainer lug one-quarter turn.

C. Pressure-Sealed Joints: Use UL-listed tool and procedure. Include use of specific equipment, pressure-sealing tool, and accessories.

D. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

E. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

1. NPS 2 (DN 50) and Smaller: Use dielectric unions, couplings, or nipples.
2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
3. NPS 5 (DN 125) and Larger: Use dielectric flange insulation kits.

3.8 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 33 Section "Water Distribution" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 33 Section "Water Distribution" for backflow preventers.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.9 PIPING INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.

D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install drain valves on standpipes.

K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

L. Install alarm devices in piping systems.

M. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. Install standpipe system piping according to NFPA 14.
2. Install sprinkler system piping according to NFPA 13.

N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

O. Fill wet-standpipe system piping with water.

P. Fill wet-pipe sprinkler system piping with water.

3.10 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

3.11 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used.

3.12 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire department connections in vertical wall.

B. Install ball drip valve at each check valve for fire department connection.

3.13 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Electrical Connections: Power wiring is specified in Division 26.

G. Connect alarm devices to fire alarm.

H. Ground equipment according to Division 26 Section "Grounding and Bonding."

I. Connect wiring according to Division 26 Section "Conductors and Cables."

J. 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.

3.14 LABELING , IDENTIFICATION, AND PAINTING

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 23 Section "Mechanical Identification." All identification signs must be securely attached to prevent tampering and/ or removal.

B. All exposed pipe and fittings must be primed and painted red.

3.15 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Energize circuits to electrical equipment and devices.
4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
5. Coordinate with fire alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.16 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.17 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. KOBOLD Instruments, Inc.
3. Marsh Bellofram.
4. Trerice, H. O. Co.

5. Weiss Instruments, Inc.
6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.

C. Element: Bourdon tube or other type of pressure element.

D. Movement: Mechanical, connecting element and pointer.

E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

F. Pointer: Red or other dark-color metal.

G. Window: Glass.

H. Ring: Stainless steel.

I. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

J. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.

K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Marsh Bellofram.
5. Miljoco Corp.
6. NANMAC Corporation.
7. Noshok, Inc.
8. Palmer - Wahl Instruments Inc.
9. REO TEMP Instrument Corporation.
10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.3 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. KOBOLD Instruments, Inc.
6. Marsh Bellofram.
7. Miljoco Corp.
8. Noshok, Inc.
9. Palmer - Wahl Instruments Inc.
10. REO TEMP Instrument Corporation.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4 , bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure .
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200 deg F shall be CR.

E. Test Kit: Furnish one test kit containing one pressure gage and adaptor, two thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
4. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install direct-mounting, vapor-actuated dial thermometers in the inlet and outlet of each boiler, domestic hot-water storage tank, and hot water recirculating pump.

B. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending a minimum of 2 inches into fluid, or to center of pipe, and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

D. Install needle-valve and snubber fitting in piping for each pressure gage.

E. Install test plugs in tees in piping.

F. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.

G. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following general-duty valves:

1. Bronze angle valves.
2. Copper-alloy ball valves.
3. Ferrous-alloy butterfly valves.
4. High-pressure butterfly valves.
5. Bronze check valves.
6. Gray-iron swing check valves.
7. Ferrous-alloy wafer check valves.
8. Bronze gate valves.
9. Cast-iron gate valves.
10. Bronze globe valves.
11. Cast-iron globe valves.
12. Chainwheel actuators.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-waterpiping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE ANGLE VALVES

A. Available Manufacturers:

1. Type 3, Bronze Angle Valves with Metal Disc and Renewable Seat:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Grinnell Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.

B. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 3, Class 200, Bronze Angle Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

2.4 COPPER-ALLOY BALL VALVES

A. Available Manufacturers:

1. Three-Piece, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. DynaQuip Controls.
c. Grinnell Corporation.
d. Hammond Valve.
e. Jamesbury, Inc.
f. Kitz Corporation of America.
g. NIBCO INC.
h. PBM, Inc.
i. Red-White Valve Corp.
j. Worcester Controls.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

2.5 FERROUS-ALLOY BUTTERFLY VALVES

A. Available Manufacturers:

1. Flanged, Ferrous-Alloy Butterfly Valves:

a. Bray International, Inc.
b. Cooper Cameron Corp.; Cooper Cameron Valves Div.
c. Grinnell Corporation.
d. Mueller Steam Specialty.
e. Tyco International, Ltd.; Tyco Valves & Controls.

2. Grooved-End, Ductile-Iron Butterfly Valves:

a. Central Sprinkler Co.; Central Grooved Piping Products.
b. Grinnell Corporation.
c. Hammond Valve.
d. McWane, Inc.; Kennedy Valve Div.
e. Milwaukee Valve Company.
f. Mueller Steam Specialty.
g. NIBCO INC.
h. Victaulic Co. of America.

B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.

C. Flanged, 300-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one or two-piece stem.

D. Grooved-End, 300-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.

2.6 BRONZE CHECK VALVES

A. Available Manufacturers:

1. Type 3, Bronze, Swing Check Valves with Metal Disc:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.
j. Milwaukee Valve Company.
k. NIBCO INC.
l. Powell, Wm. Co.
m. Red-White Valve Corp.
n. Walworth Co.
o. Watts Industries, Inc.; Water Products Div.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 3, Class 200, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

2.7 GRAY-IRON SWING CHECK VALVES

A. Available Manufacturers:

1. Type I, Gray-Iron Swing Check Valves with Metal Seats:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Flomatic Valves.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.
j. Milwaukee Valve Company.
k. Mueller Co.

l. NIBCO INC.
m. Powell, Wm. Co.
n. Red-White Valve Corp.
o. Walworth Co.
p. Watts Industries, Inc.; Water Products Div.

2. Grooved-End, Ductile-Iron Swing Check Valves:

a. Grinnell Corporation.
b. Mueller Co.
c. Victaulic Co. of America.

B. Gray-Iron Swing Check Valves, General: MSS SP-71.

C. Type I, Class 250, gray-iron, swing check valves with metal seats.

D. 300-psig CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.8 FERROUS-ALLOY WAFER CHECK VALVES

A. Available Manufacturers:

1. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Gulf Valve Co.
c. Valve and Primer Corp.

2. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Gulf Valve Co.
c. Techno Corp.

B. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

C. Single-Plate, Class 250 or 300, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.

D. Single-Plate, Class 250 or 300, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

E. Dual-Plate, Class 250 or 300, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.

F. Dual-Plate, Class 250 or 300, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

2.9 BRONZE GATE VALVES

A. Available Manufacturers:

1. Type 1, Bronze, Nonrising-Stem Gate Valves:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.
j. Milwaukee Valve Company.
k. NIBCO INC.
l. Powell, Wm. Co.
m. Red-White Valve Corp.
n. Walworth Co.
o. Watts Industries, Inc.; Water Products Div.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 1, Class 200, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge.

2.10 CAST-IRON GATE VALVES

A. Available Manufacturers:

1. Type I, Cast-Iron, Nonrising-Stem Gate Valves:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Kitz Corporation of America.
h. Legend Valve & Fitting, Inc.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Powell, Wm. Co.
l. Red-White Valve Corp.
m. Walworth Co.
n. Watts Industries, Inc.; Water Products Div.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

C. Class 250, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.

D. Class 250, NRS, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, nonrising stem, and solid-wedge disc.

E. Class 250, OS&Y, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, rising stem, and solid-wedge disc.

2.11 BRONZE GLOBE VALVES

A. Available Manufacturers:

1. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Walworth Co.

B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 3, Class 200, Bronze Globe Valves: Bronze body with bronze disc and renewable seat.

2.12 CAST-IRON GLOBE VALVES

A. Available Manufacturers:

1. Type I, Cast-Iron Globe Valves with Metal Seats:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Kitz Corporation of America.
h. Milwaukee Valve Company.
i. NIBCO INC.

j. Powell, Wm. Co.
k. Red-White Valve Corp.
l. Walworth Co.

B. Cast-Iron Globe Valves, General: MSS SP-85.

C. Type I, Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

D. Type I, Class 250, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, gate, or plug valves.
2. Throttling Service: Angle, ball, butterfly, or globe valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 200, bronze.
2. Ball Valves, NPS 2 and Smaller: Three-piece, 600-psig CWP rating, copper alloy.
3. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 200, horizontal or vertical, bronze.
4. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 200, bronze.
5. Gate Valves, NPS 2 and Smaller: Type 1 or 2, Class 200, bronze.
6. Globe Valves, NPS 2 and Smaller: Type 2, Class 200, bronze.

D. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 : Flanged ends.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 : Flanged or threaded ends.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End, Copper Tubing and Steel Piping: Valve ends may be grooved.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for mechanical system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.

3. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." AWS D1.3, "Structural Welding Code--Sheet Steel." AWS D1.4, "Structural Welding Code--Reinforcing Steel." ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.

9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B.]Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass] with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi , 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 .
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 , if little or no insulation is required.
3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 .
4. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 .

5. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 .
6. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 .
7. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 , with steel pipe base stanchion support and cast-iron floor flange.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 , with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 , if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 .

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches .
2. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
3. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 : 12 inches long and 0.048 inch thick.
    b. NPS 4 : 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6 : 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14 : 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24 : 24 inches long and 0.105 inch thick.

4. Pipes NPS 8 and Larger: Include wood inserts.
5. Insert Material: Length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils .

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

END OF SECTION

PART 1 - GENERAL

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. Section Includes:

1. Insulation Materials:

    a. Flexible elastomeric.
    b. Mineral fiber.

2. Adhesives.
3. Mastics.
4. Lagging adhesives.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied jackets.
9. Corner angles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. Detail field application for each equipment type.

C. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

E. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000(Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A**,** with factory-applied ASJ, ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

D. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-35.
    b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    c. ITW TACC, Division of Illinois Tool Works; CB-50.
    d. Marathon Industries, Inc.; 590.
    e. Mon-Eco Industries, Inc.; 55-40.
    f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements**,** available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-30.
    b. Foster Products Corporation, H. B. Fuller Company; 30-35.
    c. ITW TACC, Division of Illinois Tool Works; CB-25.
    d. Marathon Industries, Inc.; 501.
    e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; Encacel.
    b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
    c. Marathon Industries, Inc.; 570.
    d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-10.
    b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
    d. Marathon Industries, Inc.; 550.
    e. Mon-Eco Industries, Inc.; 55-50.
    f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-52.
    b. Foster Products Corporation, H. B. Fuller Company; 81-42.
    c. Marathon Industries, Inc.; 130.
    d. Mon-Eco Industries, Inc.; 11-30.
    e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
4. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-76-8.
    b. Foster Products Corporation, H. B. Fuller Company; 95-44.

c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; Metal Jacketing Systems.
b. PABCO Metals Corporation; Surefit.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

a. Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.

4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    b. Compac Corp.; 110 and 111.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    b. Compac Corp.; 120.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products; Bands.
    b. PABCO Metals Corporation; Bands.
    c. RPR Products, Inc.; Bands.
2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) or 3/4 inch (19 mm) wide with wing or closed seal.

2.10 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with the requirements in other sections of these specifications for "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with the requirements in other sections of these specifications for "Through-Penetration Firestop Systems."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, and switches on insulated pipes and tanks. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.9 FINISHES

A. Equipment and Pipe Insulation with Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

    a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 3/4 inch thick.

C. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric**:** 1 inch (25 mm**)** thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. Aluminum, Corrugated: 0.040 inch (1.0 mm) thick.
2. Painted Aluminum, Corrugated 0.032 inch (0.81 mm) thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. Painted Aluminum, Corrugated with Z-Shaped Locking Seam: 0.040 inch (1.0 mm) thick.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes domestic water piping inside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

    a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.3 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section "Valves."

B. Balancing and drain valves are specified in Division 22 Section "Plumbing Specialties."

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

E. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

1. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. NPS 1-1/4 and NPS 1-1/2 : Hard copper tube, Type L; copper pressure fittings; and soldered joints.
3. NPS 2 : Hard copper tube, Type L; copper pressure fittings; and soldered joints.
4. NPS 2-1/2 to NPS 3-1/2 : Hard copper tube, Type L; copper pressure fittings; and soldered joints.
5. NPS 2-1/2 to NPS 3-1/2 : Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
6. NPS 4 to NPS 6 : Hard copper tube, Type L; copper pressure fittings; and soldered joints.
7. NPS 4 to NPS 6 : Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
8. NPS 8 : Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

B. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."

C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 23 Section "Basic Mechanical Materials and Methods."

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 15 Section "Meters and Gages," and drain valves and strainers are specified in Division 15 Section "Plumbing Specialties."

E. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 15 Section "Plumbing Specialties."

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices are specified in Division 15 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet : MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet : MSS Type 49, spring cushion rolls, if indicated.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch .

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4 : 72 inches with 3/8-inch rod.
3. NPS 6 : 10 feet with 5/8-inch rod.
4. NPS 8 : 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet .

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:

1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Temperature-actuated water mixing valves.
5. Strainers.
6. Outlet boxes.
7. Wall hydrants.
8. Drain valves.
9. Water hammer arresters.
10. Trap-seal primer valves.
11. Trap-seal primer systems.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in operation, and maintenance manuals.

1.5 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. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ames Co.
    b. Cash Acme.
    c. Conbraco Industries, Inc.
    d. FEBCO; SPX Valves & Controls.
    e. Rain Bird Corporation.
    f. Toro Company (The); Irrigation Div.
    g. Watts Industries, Inc.; Water Products Div.
    h. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze or Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Arrowhead Brass Products, Inc.
    b. Cash Acme.

c. Conbraco Industries, Inc.
d. Legend Valve.
e. MIFAB, Inc.
f. Prier Products, Inc.
g. Watts Industries, Inc.; Water Products Div.
h. Woodford Manufacturing Company.
i. Zurn Plumbing Products Group; Light Commercial Operation.
j. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome, nickel plated, or Rough bronze.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Watts Industries, Inc.; Water Products Div.
f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550, or steel with interior lining complying with AWWA C550 for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Reduced-Pressure-Detector, Fire-Protection Backflow-Preventer Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1047 and FMG approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Cast iron with interior lining complying with AWWA C550, or Steel with interior lining complying with AWWA C550.
6. End Connections: Flanged.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

    a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
    c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

2.3 BALANCING VALVES

A. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Memory-Stop Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Conbraco Industries, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. Hammond Valve.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Red-White Valve Corp.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.

4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Manifold, Thermostatic, Water-Mixing-Valve Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Leonard Valve Company.
    b. Powers; a Watts Industries Co.
    c. Symmons Industries, Inc.

2. Description: Factory-fabricated, thermostatically controlled, water-mixing-valve assembly in three-valve parallel arrangement.
3. Large-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
4. Intermediate-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
5. Small-Flow Parallel: Thermostatic water mixing valve.
6. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
7. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
8. Component Pressure Ratings: 125 psig minimum, unless otherwise indicated.
9. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
10. Piping Finish: Copper.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve.

2.6 WALL HYDRANTS

A. Non-Freeze Wall Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company.
    b. MIFAB, Inc.
    c. Prier Products, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products Inc.
    g. Woodford Manufacturing Company.
    h. Zurn Plumbing Products Group; Light Commercial Operation.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig .
4. Operation: T-Handle key.
5. Inlet: NPS 3/4 or NPS 1 .
6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Nozzle and Wall-Plate Finish: Polished nickel bronze.
10. Operating Keys(s): One with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Arrowhead Brass Products, Inc.
    b. Mansfield Plumbing Products LLC.
    c. McDonald, A. Y. Mfg. Co.
    d. Prier Products, Inc.
    e. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
    f. Watts Industries, Inc.; Water Products Div.
    g. Woodford Manufacturing Company.
    h. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASSE 1019, Type A or Type B.

3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig .
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4 .
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4 .
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4 .
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. AMTROL, Inc.
    b. Josam Company.

c. MIFAB, Inc.
d. PPP Inc.
e. Sioux Chief Manufacturing Company, Inc.
f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
g. Tyler Pipe; Wade Div.
h. Watts Drainage Products Inc.
i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.9 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. MIFAB, Inc.
b. PPP Inc.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.

E. Install Y-pattern strainers for water on supply side of each pump.

F. Install outlet boxes recessed in wall.

G. Install water hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding."

C. Connect wiring according to Division 26 Section "Conductors."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Reduced-pressure-principle backflow preventers.
3. Reduced-pressure-detector, fire-protection backflow-preventer assemblies.
4. Manifold, thermostatic, water-mixing-valve assemblies.
5. Outlet boxes.
6. Supply-type, trap-seal primer valves.
7. Trap-seal primer.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 23 Section "Mechanical Identification."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Fernco, Inc.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.
5) Tyler Pipe; Soil Pipe Div.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.5 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

B. Hard Copper Tube: ASTM B 88, Types L and M , water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.6 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

   a. Dallas Specialty & Mfg. Co.
   b. Fernco, Inc.
   c. Logan Clay Products Company (The).
   d. Mission Rubber Co.
   e. NDS, Inc.
   f. Plastic Oddities, Inc.

2. Sleeve Materials:

   a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   b. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

   a. Cascade Waterworks Mfg. Co.
   b. Mission Rubber Co.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil, waste, vent, and storm drainage piping shall be:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

C. Underground, soil, waste, vent, and storm drainage piping shall be:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 33 Section "Sanitary Sewerage."

B. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Installations involving back-to-back blow-out water closets must be made with sanitary waste fittings that prevent cross flow. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for NPS 2 piping; 1 percent downward in direction of flow for piping NPS 3 and larger.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "Valves."

B. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valve are specified in Division 22 Section "Domestic Water Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    a. MSS Type 1, adjustable, steel clevis hangers.

B. Install supports according to Division 22 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet .

G. Install supports for vertical copper tubing every 10 feet .

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water . From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg . Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Miscellaneous drainage piping specialties.

1.3 SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.

e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
g. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.36.2M for cast iron, ASME A112.3.1 for stainless steel for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass or cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Light Commercial Operation.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Outlet Connection: Inside calk, Spigot, or Threaded.
7. Closure: Brass plug with straight threads and gasket, or Brass plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy; Polished bronze; Rough bronze.
10. Frame and Cover Shape: Round or Square.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts :

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.

c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, stainless-steel cover plate with screw. Provide security screw where wall access is exposed.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Commercial Enameling Co.
b. Josam Company; Josam Div.
c. MIFAB, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group; Light Commercial Operation.
h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3[with backwater valve].
3. Body Material: Gray iron.
4. Seepage Flange: As required.
5. Anchor Flange: As required.
6. Clamping Device: As required.
7. Outlet: Bottom or Side.
8. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
9. Top or Strainer Material: Bronze, Gray iron, Nickel bronze, or Stainless steel.
10. Top of Body and Strainer Finish: Nickel bronze, Polished bronze, Rough bronze, or Stainless steel.
11. Top Shape: Round or Square.
12. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
13. Trap Material: Cast iron.
14. Trap Pattern: Deep-seal P-trap, or Standard P-trap.

15. Trap Features: Trap-seal primer valve drain connection.

2.3 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

    a. NPS 2 : 4-inch- minimum water seal.
    b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Mechanical Identification."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories, showers and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Kitchen sinks.
10. Service sinks.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

C. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

D. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
2. Vitreous-China Fixtures: ASME A112.19.2M.
3. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Faucets: ASME A112.18.1.

2. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
3. NSF Potable-Water Materials: NSF 61.
4. Pipe Threads: ASME B1.20.1.
5. Supply Fittings: ASME A112.18.1.
6. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Faucets: ASME A112.18.1.
4. Hand-Held Showers: ASSE 1014.
5. Hose-Coupling Threads: ASME B1.20.7.
6. Pipe Threads: ASME B1.20.1.
7. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Brass Waste Fittings: ASME A112.18.2.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Commercial Applications: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Standard Companies, Inc.
b. Bradley Corporation.
c. Chicago Faucets.
d. Delta Faucet Company.
e. Eljer.
f. Elkay Manufacturing Co.
g. Kohler Co.
h. Moen, Inc.
i. Royal Brass Mfg. Co.
j. Speakman Company.
k. T & S Brass and Bronze Works, Inc.
l. Zurn Plumbing Products Group; Commercial Brass Operation.

2.2 SHOWER FAUCETS

A. Shower Faucets:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Standard Companies, Inc.
b. Chicago Faucets.
c. Delta Faucet Company.
d. Eljer.
e. Kohler Co.

f. Leonard Valve Company.
g. Moen, Inc.
h. Powers; a Watts Industries Co.
i. Royal Brass Mfg. Co.
j. Speakman Company.
k. Symmons Industries, Inc.
l. T & S Brass and Bronze Works, Inc.
m. Zurn Plumbing Products Group; AquaSpec Commercial Faucet Operation.
n. Zurn Plumbing Products Group; Wilkins Operation.

2.3 SINK FAUCETS

A. Sink Faucets:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Standard Companies, Inc.
b. Bradley Corporation.
c. Chicago Faucets.
d. Delta Faucet Company.
e. Eljer.
f. Elkay Manufacturing Co.
g. Kohler Co.
h. Moen, Inc.
i. Royal Brass Mfg. Co.
j. Speakman Company.
k. T & S Brass and Bronze Works, Inc.
l. Zurn Plumbing Products Group; Commercial Brass Operation.

2.4 FLUSHOMETERS

A. Flushometers,:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Delta Faucet Company.
b. Sloan Valve Company.
c. Zurn Plumbing Products Group; Commercial Brass Operation.

2.5 TOILET SEATS

A. Toilet Seats:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Standard Companies, Inc.
    b. Bemis Manufacturing Company.
    c. Centoco Manufacturing Corp.
    d. Eljer.
    e. Kohler Co.
    f. Olsonite Corp.

2.6 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Engineered Brass Co.
    b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
    c. McGuire Manufacturing Co., Inc.
    d. Plumberex Specialty Products Inc.
    e. TCI Products.
    f. TRUEBRO, Inc.
    g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. TRUEBRO, Inc.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.7 FIXTURE SUPPORTS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

C. Water-Closet Supports:

1. Description: Combination carrier designed for accessible mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

D. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Type II, urinal carrier with hanger and bearing plates for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

E. Lavatory Supports:

1. Description: Type I, lavatory carrier with exposed arms and tie rods. Type II, lavatory carrier with concealed arms and tie rod. Type III, lavatory carrier with hanger plate and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.8 WATER CLOSETS

A. Water Closets:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Plumbing, L.L.C./Fiat Products.
b. American Standard Companies, Inc.
c. Eljer.
d. Kohler Co.

2.9 URINALS

A. Urinals:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Standard Companies, Inc.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Eljer.
d. Kohler Co.

2.10 LAVATORIES

A. Lavatories:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Standard Companies, Inc.
b. Eljer.
c. Kohler Co.
d. Crane Plumbing, L.L.C./Fiat Products.

2.11 KITCHEN SINKS

A. Kitchen Sinks:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Eljer.
b. Kohler Co.
c. American Standard Companies, Inc.
d. Dayton Products, Inc.

e. Elkay Manufacturing Co.
f. Just Manufacturing Company.

2.12 SERVICE SINKS

A. Service Sinks:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Acorn Engineering Company.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Florestone Products Co., Inc.
d. Precast Terrazzo Enterprises, Inc.
e. Stern-Williams Co., Inc.
f. Mustee, E. L. & Sons, Inc.
g. Swan Corporation (The).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "Valves."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install toilet seats on water closets.

M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install shower flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 23 Section "Basic Mechanical Materials and Methods."

S. Set service sinks in leveling bed of cement grout. Grout is specified in Division 23 Section "Basic Mechanical Materials and Methods."

T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding."

D. Connect wiring according to Division 26 Section "Conductors."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Mechanical demolition.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, and unexcavated spaces.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All equipment and material stored outside must be kept elevated to prevent damage.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
3. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

    a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

    a. NIBCO INC.
    b. NIBCO, Inc.; Chemtrol Div.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F .

1. Manufacturers:

    a. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Eclipse, Inc.
    d. Epco Sales, Inc.
    e. Hart Industries, International, Inc.
    f. Watts Industries, Inc.; Water Products Div.
    g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

    a. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Epco Sales, Inc.
    d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F .

1. Manufacturers:

    a. Calpico, Inc.
    b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .

1. Manufacturers:

    a. Perfection Corp.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Co., Inc.
    d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co.
    d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM, NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic, Carbon steel, Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated, Polished chrome-plated and rough brass.

C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated, Polished chrome-plated and rough brass.

D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

E. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

a. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
b. Insulated Piping: One-piece, stamped-steel type with spring clips.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or Split-casting, cast-brass type with polished chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.

M. Sleeves are not required for core-drilled holes. Coordinate core drilling location with all other trades including the structure.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, repair or replacement of components and meet the NEC access clearances. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes basic requirements for factory-installed motors.

1.3 DEFINITIONS

A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:

1. Compatible with the following:

    a. Magnetic controllers.
    b. Multispeed controllers.
    c. Reduced-voltage controllers.

2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
3. Matched to torque and horsepower requirements of the load.
4. Matched to ratings and characteristics of supply circuit and required control sequence.

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS

A. Motor requirements apply to factory-installed motors except as follows:

1. Different ratings, performance, or characteristics for motor are specified in another Section.
2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.2 MOTOR CHARACTERISTICS

A. Frequency Rating: 60 Hz.

B. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

C. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.

D. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.

E. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

F. Enclosure: Open dripproof.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium, as defined in NEMA MG 1.

C. Stator: Copper windings, unless otherwise indicated.

1. Multispeed motors shall have separate winding for each speed.

D. Rotor: Squirrel cage, unless otherwise indicated.

E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating, unless otherwise indicated.

G. Insulation: Class F, unless otherwise indicated.

H. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.

1. Finish: Gray enamel.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.

1. Finish: Chemical-resistant paint over corrosion-resistant primer.

2.5 SINGLE-PHASE MOTORS

A. Type: One of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split-phase start, capacitor run.
3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

PART 3 - EXECUTION

END OF SECTION

SECTION 230548

VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Restrained elastomeric isolation mounts.
3. Freestanding and restrained spring isolators.
4. Housed spring mounts.
5. Elastomeric hangers.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Pipe riser resilient supports.
9. Resilient pipe guides.
10. Restraining braces and cables.
11. Steel and inertia vibration isolation equipment bases.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Limit stop as required for equipment.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

E. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

F. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

G. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

H. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a

maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

I. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

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

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Isolation Technology, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation.
8. Vibration Mountings & Controls, Inc.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application.

3.3 VIBRATION-CONTROL DEVICE INSTALLATION

A. Comply with requirements in Division 7 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

C. Attachment to Structure: Anchor bracing to structure at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers..

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:

    a. Manufacturer, product name, model number, and serial number.
    b. Capacity, operating and power characteristics, and essential data.
    c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches : Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches : 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Condensers, and similar motor-driven units.
2. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
3. Fans, blowers, balancing and control dampers, and mixing boxes.
4. Packaged HVAC equipment.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches , 1/2 inch for viewing distances up to 72 inches , and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Fire department hose valves.
    c. Meters, gages, thermometers, and similar units.
    d. Condensers, and similar motor-driven units.
    e. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
    f. Fans, blowers, balancing and control dampers, and mixing boxes.
    g. Packaged HVAC equipment.

C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:

    a. Green: For cooling equipment and components.
    b. Yellow: For heating equipment and components.
    c. Green and Yellow or Orange: For combination cooling and heating equipment and components.
    d. Brown: For energy-reclamation equipment and components.

2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches , 1/2 inch for viewing distances up to 72 inches , and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Include signs for the following general categories of equipment:

    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Compressors, chillers, condensers, and similar motor-driven units.
    c. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
    d. Fans, blowers, balancing and control dampers, and mixing boxes.
    e. Packaged HVAC equipment.

D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches : Pretensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, Less Than 6 Inches : Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.5 CLEANING

A. Clean faces of mechanical identification devices.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:

    a. Constant-volume air systems.
2. Verifying that automatic control devices are functioning properly.
3. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

F. Report Forms: Test data sheets for recording test data in logical order.

G. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

H. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

I. TAB: Testing, adjusting, and balancing.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of systems or equipment.

L. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: 45 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 4copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements.
b. The Contract Documents examination report.
c. TAB plan.
d. Work schedule and Project-site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from TAB firm's forms approved by Architect.

E. Instrumentation Type, Quantity, and Accuracy: As described in National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems forms stating that AABC or NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201,

"Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices such as manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine equipment for installation and for properly operating safety interlocks and controls.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Equipment and duct access doors are securely closed.
3. Balance dampers are open.
4. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
5. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems and this Section.

B. Cut insulation, ducts, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

3.7 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems

found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.9 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.

14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fan performance forms including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Fan drive settings including settings and percentage of maximum pitch diameter.
    e. Settings for supply-air, static-pressure controller.
    f. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Balancing stations.
4. Position of balancing devices.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches , and bore.
    i. Sheave dimensions, center-to-center, and amount of adjustments in inches
    j. Number of belts, make, and size.
    k. Number of filters, type, and size.

2. Motor Data:

    a. Make and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches , and bore.
    f. Sheave dimensions, center-to-center, and amount of adjustments in inches .

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm .
b. Total system static pressure in inches wg .
c. Fan rpm.
d. Discharge static pressure in inches wg .
e. Filter static-pressure differential in inches wg .
f. Cooling coil static-pressure differential in inches wg .
g. Heating coil static-pressure differential in inches wg .
h. Outside airflow in cfm .
i. Return airflow in cfm .
j. Outside-air damper position.
k. Return-air damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft. .
h. Tube size in NPS .
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm .
b. Average face velocity in fpm .
c. Air pressure drop in inches wg .
d. Outside-air, wet- and dry-bulb temperatures in deg F .
e. Return-air, wet- and dry-bulb temperatures in deg F .
f. Entering-air, wet- and dry-bulb temperatures in deg F .
g. Leaving-air, wet- and dry-bulb temperatures in deg F .
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig .
j. Refrigerant suction temperature in deg F .
k. Inlet steam pressure in psig .

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btuh .
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm .
i. Face area in sq. ft. .
j. Minimum face velocity in fpm .

2. Test Data (Indicated and Actual Values):

a. Heat output in Btuh .
b. Airflow rate in cfm .
c. Air velocity in fpm .
d. Entering-air temperature in deg F .
e. Leaving-air temperature in deg F .
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches , and bore.
h. Sheave dimensions, center-to-center, and amount of adjustments in inches

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches , and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches
g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm .
b. Total system static pressure in inches wg .
c. Fan rpm.
d. Discharge static pressure in inches wg .
e. Suction static pressure in inches wg .

J. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F .
d. Duct static pressure in inches wg .
e. Duct size in inches .
f. Duct area in sq. ft. .
g. Indicated airflow rate in cfm .
h. Indicated velocity in fpm .
i. Actual airflow rate in cfm .
j. Actual average velocity in fpm .
k. Barometric pressure in psig .

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft. .

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm .
b. Air velocity in fpm .
c. Preliminary airflow rate as needed in cfm .
d. Preliminary velocity as needed in fpm .
e. Final airflow rate in cfm .
f. Final velocity in fpm .
g. Space temperature in deg F .

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
c. Verify that balancing devices are marked with final balance position.
d. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner/Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Owner/Architect.
3. Owner/Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.

7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

    a. Flexible elastomeric.
    b. Mineral fiber.

2. Fire-rated insulation systems.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied cloths.
9. Tapes.
10. Securements.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, and specialties for each type of insulation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields.

B. Coordinate clearance requirements with duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, with factory-applied jacket.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; All-Service Duct Wrap.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F (927 deg C). Comply with ASTM C 656, Type II, Grade 6. tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Johns Manville; Super Firetemp M.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-30.
    b. Foster Products Corporation, H. B. Fuller Company; 30-35.
    c. ITW TACC, Division of Illinois Tool Works; CB-25.
    d. Marathon Industries, Inc.; 501.
    e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; Encacel.
    b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
    c. Marathon Industries, Inc.; 570.
    d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-10.
    b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    c. ITW TACC, Division of Illinois Tool Works; CB-05/15.

d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Duct Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; Chil-Glas No. 5.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm), in a Leno weave, for duct, equipment, and pipe.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).

3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    b. Compac Corp.; 110 and 111.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
    e. <Insert manufacturer's name; product name or designation.>

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    b. Compac Corp.; 120.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.10 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in other sections of these specifications for "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in other sections of these specifications for "Through-Penetration Firestop Systems."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings:

1. Install insulation over fittingsners, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly

against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
5. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

C. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable union insulation from sectional pipe insulation of same thickness as that on adjoining pipe.
2. When union covers are made from sectional pipe insulation, extend insulation from union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

c. Do not overcompress insulation during installation.
d. Impale insulation over pins and attach speed washers.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

   1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.9 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.10 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
3. Inspect pipe and fittings randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed outdoor air.
2. Indoor, exposed outdoor air.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

3.13 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed and exposed, round, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

B. Concealed and exposed, rectangular, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

C. Concealed and exposed, outdoor-air plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

3.14 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.

3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2 inches (50 mm) thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2 inches (50 mm) thick.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Concealed:

1. None.

C. Piping, Exposed:

1. None.

3.18 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. None

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-22:

1. Suction Lines for Air-Conditioning Applications: 185 psig (1276 kPa).
2. Hot-Gas and Liquid Lines: 325 psig (2241 kPa).

B. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
2. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
3. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Filter dryers.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. 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. Field quality-control test reports.

D. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

D. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.

2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig (3450 kPa).

B. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F (4.4 deg C).
6. Superheat: Adjustable.
7. End Connections: Socket, flare, or threaded union.
8. Working Pressure Rating: 450 psig (3100 kPa).

C. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

D. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina orcharcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig (14 kPa).
8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 240 deg F (116 deg C).

2.3 REFRIGERANTS

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

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-22: Monochlorodifluoromethane.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-22

A. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.3 VALVE AND SPECIALTY APPLICATIONS

A. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

B. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

C. Install filter dryers in liquid line between compressor and thermostatic expansion valve**,** and in the suction line at the compressor.

3.4 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. 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.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. 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 8 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

L. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Liquid lines may be installed level.

M. When brazing or soldering, 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 pipe sleeves at penetrations in exterior walls and floor assemblies.

O. Seal penetrations through fire and smoke barriers with "Through-Penetration Firestop Systems."

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

R. Seal pipe penetrations through exterior walls with "Joint Sealants."

S. Identify refrigerant piping and valves according to Division 23 Section "Mechanical Identification."

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.6 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 22 Section "Hangers and Supports."

B. Install the following pipe attachments:

1. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).

4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).

D. Support multi-floor vertical runs at least at each floor.

3.7 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 refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.8 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).

3.9 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust set-point temperature of air-conditioning controllers to the system design temperature.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 2-inch wg . Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round, spiral-seam ducts and formed fittings.

1.3 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports.

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

C. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

D. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

E. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.5 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.

2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.6 ROUND DUCT AND FITTING FABRICATION

A. Round, Spiral Lock-Seam Ducts: Fabricate ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Manufacturers:

a. McGill AirFlow Corporation.
b. SEMCO Incorporated.
c. Lindab, Inc.
d. Eastern Sheet Metal

B. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

a. Manufacturers:

1) Ductmate Industries, Inc.
2) Lindab Inc.
3) Eastern Sheet Metal

C. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

D. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

E. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg :

    a. Ducts 3 to 36 Inches in Diameter: 0.034 inch .
    b. Ducts 37 to 50 Inches in Diameter: 0.040 inch .
    c. Ducts 52 to 60 Inches in Diameter: 0.052 inch .
    d. Ducts 62 to 84 Inches in Diameter: 0.064 inch .

3. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
4. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
5. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
7. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
8. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
9. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg : 0.022 inch .

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts: 2-inch wg .
2. Return Ducts (Negative Pressure): 2-inch wg .
3. Exhaust Ducts (Negative Pressure): 2-inch wg .

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches , with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches .

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories."

O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

P. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round ducts and Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures).

4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.7 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.
2. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and re-inspect ducts.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Volume dampers.
2. Motorized control dampers.
3. Fire dampers.
4. Turning vanes.
5. Duct-mounting access doors.
6. Flexible connectors.
7. Duct accessory hardware.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Volume dampers.
2. Motorized control dampers.
3. Fire dampers.
4. Turning vanes.
5. Duct-mounting access doors.
6. Flexible connectors.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.
4. Fire-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Stainless Steel: ASTM A 480/A 480M.

C. Aluminum Sheets: ASTM B 209 , alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: ASTM B 221 , alloy 6063, temper T6.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

2.3 VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Flexmaster U.S.A., Inc.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.
10. Lindab, Inc.

11. Eastern Sheet Metal

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: [Galvanized steel.
4. Bearings: Oil-impregnated bronze, Molded synthetic, or Stainless-steel sleeve.
5. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat, U, or Angle-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Oil-impregnated bronze, Molded synthetic, or Stainless-steel sleeve thrust or ball.
5. Blade Seals: Felt, Vinyl, or Neoprene.
6. Jamb Seals: Cambered stainless steel or aluminum.
7. Tie Bars and Brackets: Galvanized steel or Aluminum.

E. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 MOTORIZED CONTROL DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. CESCO Products.
4. Duro Dyne Corp.
5. Greenheck.
6. McGill AirFlow Corporation.
7. METALAIRE, Inc.
8. Nailor Industries Inc.
9. Penn Ventilation Company, Inc.
10. Ruskin Company.
11. Vent Products Company, Inc.

B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch- thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- thick, galvanized-steel damper blades with maximum blade width of 8 inches .

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F .
3. Provide parallel- or opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is being held by torque of 50 in. x lbf ; when tested according to AMCA 500D.

2.5 FIRE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. CESCO Products.
3. Greenheck.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Prefco Products, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.
11. Ward Industries, Inc.

B. Fire dampers shall be labeled according to UL 555.

C. Fire dampers shall be rated for dynamic HVAC systems.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Fusible Links: Replaceable, 212 deg F rated.

2.6 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.
d. Ward Industries, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.7 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:

a. American Warming and Ventilating.
b. CESCO Products.
c. Ductmate Industries, Inc.
d. Flexmaster U.S.A., Inc.
e. Greenheck.
f. McGill AirFlow Corporation.
g. Nailor Industries Inc.
h. Ventfabrics, Inc.
i. Ward Industries, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

a. Less Than 12 Inches Square: Secure with two sash locks.
b. Up to 18 Inches Square: Two hinges and two sash locks.
c. Up to 24 by 48 Inches : Three hinges and two compression latches.
d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd. .
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F .

2.9 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.

C. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

D. Provide test holes at fan inlets and outlets and elsewhere as indicated.

E. Install fire dampers, with fusible links, according to manufacturer's UL-approved written instructions.

F. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers**,** turning vanes**,** and equipment.
3. Adjacent to fire dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
5. On sides of ducts where adequate clearance is available.

G. Install the following sizes for duct-mounting, rectangular access doors:

1. Two-Hand Access: 12 by 6 inches.

H. Install the following sizes for duct-mounting, round access doors:

1. Two-Hand Access: 10 inches in diameter.

I. Label access doors according to Division 23 Section "Mechanical Identification."

J. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

K. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

L. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.
2. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL standards for intended application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

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

1. Carnes Company HVAC.
2. Greenheck.
3. Loren Cook Company.

4. Penn Ventilation.
5. Twin City Fan Co.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle, extruded-aluminum, rectangular top, galvanized steel, mushroom-domed top; square, one-piece, aluminum base with venturi inlet cone.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Mounted inside or outside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange, Built-in cant and mounting flange, Built-in raised cant and mounting flange.
2. Overall Height: 12 inches (300 mm), unless otherwise indicated.
3. Pitch Mounting: Manufacture curb for roof slope.
4. Metal Liner: Galvanized steel.

2.2 IN-LINE CENTRIFUGAL FANS

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

1. Carnes Company HVAC.
2. Greenheck.
3. Loren Cook Company.
4. Penn Ventilation.

B. Description: In-line, direct-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Companion Flanges: For inlet and outlet duct connections.
3. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

2.3 MOTORS

A. Comply with requirements in Division 23 Section "Motors."

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using spring isolators, restrained spring isolators having a static deflection of 1 inch (25 mm). Vibration- and seismic-control devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."

1. Secure vibration controls to concrete bases using anchor bolts cast in concrete base.

C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware.

D. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch (25 mm).

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Division 23 Section "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to the requirements of Division 26.

D. Connect wiring according to the requirements of Division 26.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust damper linkages for proper damper operation.
6. Verify lubrication for bearings and other moving parts.
7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
9. Shut unit down and reconnect automatic temperature-control operators.
10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the products specified.

2.2 GRILLES AND REGISTERS

A. Security Grille and Register:

1. Manufacturers:

a. A-J Manufacturing Co., Inc.
b. Anemostat; a Mestek Company.
c. Carnes.
d. Hart & Cooley, Inc.; Hart & Cooley Div.
e. Krueger.
f. Metalaire Industries
g. Nailor Industries of Texas Inc.
h. Price Industries.
i. Titus.
j. Tuttle & Bailey.

2. General: Material, face arrangement, finish, wall sleeve, mounting, and damper requirements are indicated on the plans.

B. Fixed Face Grille and Register:

1. Manufacturers:

a. A-J Manufacturing Co., Inc.
b. Anemostat; a Mestek Company.
c. Carnes.
d. Dayus Register & Grille.
e. Hart & Cooley, Inc.; Hart & Cooley Div.
f. Krueger.
g. Metalaire Industries
h. Nailor Industries of Texas Inc.
i. Price Industries.
j. Titus.
k. Tuttle & Bailey.
l.

2. General: Material, finish, face arrangement, frame, mounting frame, mounting, and damper requirements are indicated on the plans.

2.3 CEILING DIFFUSER OUTLETS

A. Rectangular and Square Ceiling Diffusers:

1. Manufacturers:

a. A-J Manufacturing Co., Inc.
b. Anemostat; a Mestek Company.
c. Carnes.
d. Hart & Cooley, Inc.; Hart & Cooley Div.
e. Krueger.
f. METALAIRE, Inc.; Metal Industries Inc.
g. Nailor Industries of Texas Inc.
h. Price Industries.
i. Titus.
j. Tuttle & Bailey.

2. General: Material, finish, face size, face style, mounting, pattern, damper and accessories are indicated on the plans.

B. Louver Face Diffuser:

1. Manufacturers:

a. A-J Manufacturing Co., Inc.
b. Anemostat; a Mestek Company.
c. Carnes.
d. METALAIRE, Inc.; Metal Industries Inc.
e. Nailor Industries of Texas Inc.
f. Price Industries.
g. Titus.
h. Tuttle & Bailey.

2. General: Material, finish, face size, mounting, Pattern, dampers, and accessories are indicated on the plans.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling.
2. Hot-gas reheat.
3. Electric-heating coils.
4. Outdoor- and return-air damper section.
5. Space temperature controls.
6. Roof curbs.

1.3 DEFINITIONS

A. ECM: Electrically commutated motor.

B. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

C. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

D. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with ASHRAE/IESNA 90.1 for minimum efficiency of heating and cooling.

C. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

D. UL Compliance: Comply with UL 1995.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three number years from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. AAON, Inc.
2. Carrier Corporation.
3. Trane; American Standard Companies, Inc.
4. YORK International Corporation.

2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

1. Exterior Casing Thickness: Manufacturer’s standard casing.

C. Inner Casing Fabrication Requirements:

1. Inside Casing: Galvanized steel, manufacturer’s standard thickness.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1 inch (25 mm).
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches (50 mm) deep, and complying with ASHRAE 62.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple both sides of drain pan.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

2.3 FANS

A. Direct-Driven Supply-Air Fans: Double width, forward curved or backward inclined, centrifugal; with permanently lubricated, multispeed or ECM motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

2.4 COILS

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Coil Split: Interlaced.
4. Baked phenolic coating.
5. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.

B. Hot-Gas Reheat Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Baked phenolic coating.

C. Electric-Resistance Heating:

1. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

2. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
3. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
4. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:

    a. Magnetic or Mercury contactors.
    b. Step Controller: Pilot lights and override toggle switch for each step.
    c. Time-delay relay.
    d. Airflow proving switch.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: One or Two.

B. Compressor: Hermetic, reciprocating; Semihermetic, reciprocating; Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

C. Refrigeration Specialties:

1. Refrigerant Charge: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated: Minimum 90 percent arrestance, and MERV 7.

2.7 DAMPERS

A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized damper.

B. Return-Air Damper: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet.

1. Damper Motor: Two-position with 120 VAC actuator.

2.8 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.9 CONTROLS

A. Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat with the following features:

   a. Heat-cool-off switch.
   b. Fan on-auto switch.
   c. Automatic changeover.
   d. Adjustable deadband.
   e. Exposed set point.
   f. Exposed indication.
   g. Degree F indication.
   h. Unoccupied-period-override push button.
   i. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply-air temperature, operating mode, and status.

B. Electronic Controller:

1. Controller shall have volatile-memory backup.

2. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
3. Unoccupied Period:

   a. Heating Setback: 10 deg F (5.6 deg C).
   b. Cooling Setback: System off.
   c. Override Operation: Two hours.

4. Supply Fan Operation:

   a. Occupied Periods: Run fan continuously.
   b. Unoccupied Periods: Cycle fan to maintain setback temperature.

5. Refrigerant Circuit Operation:

    a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain room temperature and humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
    b. Unoccupied Periods: Compressors off.

6. Hot-Gas Reheat-Coil Operation:

    a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
    b. Unoccupied Periods: Reheat not required.

7. Electric-Heating-Coil Operation:

    a. Occupied Periods: Stage coil to maintain room temperature.
    b. Unoccupied Periods: Energize coil to maintain setback temperature.

8. Fixed Minimum Outdoor-Air Damper Operation:

    a. Occupied Periods: Open to preset valve as determined by the test and balance contractor.
    b. Unoccupied Periods: Close the outdoor-air damper.

2.10 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Coil guards of painted, galvanized-steel wire.

C. Hail guards of galvanized steel, painted to match casing.

2.11 ROOF CURBS

A. Roof curbs shall be furnished with vibration isolators.

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

    a. Materials: ASTM C 1071, Type I or II.
    b. Thickness: 2 inches (50 mm).

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

    a. Liner Adhesive: Comply with ASTM C 916, Type I.
    b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
    c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.

C. Curb Height: 14 inches (355 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction. Secure RTUs to upper curb rail, and secure curb base to roof framing.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

B. Install piping adjacent to RTUs to allow service and maintenance.

C. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors.
4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, coils, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.

6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Clean condenser coil and inspect for construction debris.
9. Remove packing from vibration isolators.
10. Verify lubrication on fan and motor bearings.
11. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
12. Adjust fan belts to proper alignment and tension.
13. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

14. Inspect and record performance of interlocks and protective devices; verify sequences.
15. Operate unit for an initial period as recommended or required by manufacturer.

16. Calibrate thermostats.
17. Adjust and inspect high-temperature limits.
18. Inspect dampers for proper stroke.
19. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

20. Inspect controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.
21. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Outdoor-air intake volume.

22. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

23. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. Low-temperature safety operation.

24. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Units shall be designed to operate with HCFC-free refrigerants.

1.5 COORDINATION

A. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Carrier Air Conditioning; Div. of Carrier Corporation.
2. Mitsubishi Electronics America, Inc.; HVAC Division.
3. Sanyo Fisher (U.S.A.) Corp..

2.2 CONCEALED EVAPORATOR-FAN COMPONENTS

A. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

D. Fan Motors: Comply with requirements in Division 15 Section "Motors."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Disposable Filters: 1 inch (25 mm) thick, in fiberboard frames.

F. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.3 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 15 Section "Motors."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

2.4 CEILING-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan, and integral condensate pump.

D. Fan Motors: Comply with requirements in Division 15 Section "Motors."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

2.5 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Reciprocating or Scroll.
2. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
3. Refrigerant Charge: R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).

H. Mounting Base: Polyethylene.

2.6 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection, including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install compressor-condenser components on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Install piping adjacent to unit to allow service and maintenance.

B. Ground equipment.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 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.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. General Conditions of the Contract, Special Conditions and Instructions to Bidders contained herein are a part of these specifications.

B. This Contractor shall furnish all labor, materials and equipment and perform all operations necessary for installation of complete electrical work within the intent of, and as indicated on, the Drawings and as herein specified.

1.2 CONTRACT DOCUMENTS

A. The contract drawings are diagrammatic and are not intended to indicate every detail of construction, or every item of material or equipment required.

B. Contractor shall maintain on the job site one complete set of contract documents of all trades, and shall coordinate with other trades so as to avoid conflicts.

C. Indicated locations of outlets, equipment connections, etc. are approximate and shall be verified by reference to related documents (i.e., Architectural casework drawings, equipment shop drawings, etc.).

1.3 RECORD DRAWINGS

A. During construction of this project, contractor shall maintain one complete set of electrical contract drawings, on which shall be recorded all significant changes in equipment locations, circuit assignments, etc. This set of drawings shall be used to prepare as-built drawings to be submitted to Owner upon completion.

B. Upon completion of the project, contractor shall prepare operation and maintenance manuals for all electrical equipment, which shall include shop drawings, catalog data, equipment information, detailed maintenance instruction, wiring diagrams, warranty information, etc. for the electrical installation. Submit three copies to the Architect/Engineer for approval and presentation to the Owner.

1.4 REGULATIONS AND COMPLIANCE

A. Latest editions of National Electrical Code, state codes or ordinances govern this work. All their requirements shall be satisfied.

B. This Contractor shall secure and pay for all permits, fees, inspections and licenses required (see Article 10 of the General Conditions). Upon completion of job, he shall present to the Architect/Engineer a certificate of inspection and approval from inspection authorities.

1.5 UTILITY COORDINATION

A. This Contractor shall verify with the serving electric, telephone and cable TV utilities all respective utility requirements for the provision of service for this project. All fees, materials and labor required for service installations shall be included in the bid.

B. Should utility requirements vary greatly from those shown on the drawings, the contractor shall notify the Architect/Engineer of those requirements prior to bid. Additional costs associated with utility services shall not be grounds for change order without pre-bid notification or bid clarification.

1.6 TILT UP CONSTRUCTION COORDINATION

A. Tilt up concrete construction requires special and extra coordination of trades with the general contractor for installation of boxes and conduit in the structural walls.

B. The intent is that all required electrical installation in tilt up walls not provided with furred gypsum wallboard be concealed in the concrete. Surface mounted boxes and conduit on exposed tilt up walls shall not be acceptable; this includes receptacles or other equipment indicated on the exterior side of the walls.

1.7 TEST AND GUARANTEE

A. Upon completion of work, contractor shall demonstrate installation and make such test as may be required to satisfy the Architect/Engineer and Owner that work is installed in accordance with drawings, specifications and instructions.

B. Contractor shall guarantee the work done in accordance with drawings and specifications, and to be free of imperfect materials and defective workmanship. Anything unsatisfactory shall be corrected immediately and at contractor's expense.

C. For a period of one year after acceptance, contractor shall replace, without any expense to the Owner, any imperfect materials or defective workmanship.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall be new, with required Underwriter's Laboratories label, and manufacturer's label or nameplate giving complete electrical data.

B. Where a manufacturer's catalog number is used, all parts shall be furnished to make it complete and fit the construction intended.

2.2 SUBMITTALS, ETC.

A. Within twenty days after award of contract, contractor shall submit to Architect/Engineer a complete list in triplicate of ALL materials he proposes to use.

List shall show a single manufacturer for each item. List shall include not only major materials and equipment, but also such items as conduit fittings, bushings, ground clamps, anchors, outlet boxes, gutters, terminal cabinets, splice connections, fuses, etc.

B. Materials shall be provided by manufacturer and catalog number given in these specifications or shown on drawings or approved equal. If contractor wishes to furnish another make or number, he shall furnish complete, detailed data and obtain approval of it in writing from the Architect/ Engineer.

C. Submit cuts of fixtures, shop drawings on panels, and any other descriptive materials requested, in six copies.

D. Completely adequate housing shall be provided on the site for orderly and careful storage of all materials and equipment.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Required excavation and backfill for installation of all electrical work shall be provided by the Electrical Contractor.

3.2 CUTTING, PATCHING, ETC.

A. Contractor shall place his own sleeves and advise other trades of required chases and openings so they can be properly built-in. Where any raceways, supports, etc. installed under this contract pierce the roof, suitable pitch pockets shall be provided and coordinated with the roofing contractor as necessary to maintain roof warranty and to be acceptable to the Architect. Provide suitable fittings where any raceways or equipment cross expansion joint. Expansion fittings shall be complete with grounding type bond fittings.

B. Permitted cutting or patching necessary to the electrical installation shall be done by this contractor. Structural members shall not be cut except by written permission of Architect/Engineer.

3.3 CLEANING, ETC.

A. Contractor shall properly protect his work against damage by weather or other trades. All work shall be left well cleaned, and damaged finishes shall be restored to original condition.

B. Contractor shall keep premises free of debris resulting from his work.

3.4 PAINTING, FINISHING

A. Suitable finishes shall be provided on all items of electrical equipment, conduit, etc. which are exposed. This shall consist of either an acceptable finish as manufactured and supplied to the job or application of suitable finishes after installation.

B. Where installed in finished areas, exposed equipment, raceways, etc. (eg. panel covers, wiremold, etc.) shall be supplied with prime coat, and shall be professionally painted or enameled as directed to match or blend with adjacent surfaces.

C. In unfinished areas, such as equipment rooms, etc., exposed equipment shall be furnished with suitable factory applied finishes. (i.e., standard gray enamel finish for panelboards, etc.).

D. Equipment furnished in finishes such as stainless steel, brushed aluminum, etc. shall not be painted.

E. All finishing shall be as directed by and shall be satisfactory to the Architect/Engineer.

3.5 EQUIPMENT LABELS

A. Suitable labels shall be provided for the identification of major items of electrical equipment including switchboards, panelboards, motor starters, safety switches, enclosed circuit breakers, etc.

B. Labels shall be of engraved plastic laminate, not less than 1/16" thick, with black letters on white field.

C. Engraving shall be of professional quality, with block style letters, minimum 1/4" high.

D. Nameplates shall be attached with 2 cadmium plated screws. Nameplates shall under no conditions be attached with epoxy glue or double stick tape.

E. At the close of the project, the Contractor shall reduce, photographically, the as-built Power Riser diagram to approximately 1/2 size, frame and mount under glass. The completed 1/2 size as-built power Riser diagram shall be rigidly mounted on the main electrical room wall next to main panelboard.

F. All conduit penetrations of fire-rated assemblies shall be protected by a UL approved penetration system. This Contractor shall field verify all required locations.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install a complete system of wiring and cable as shown, specified and required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conductors shall be as manufactured by Phelps Dodge, Anaconda, Triangle, Southwire, or approved equivalent.

B. Normal trade standard "Building Wire", copper, types THHN for dry locations, THWN for wet locations. Feeders rated greater than 150 amperes may utilize compact aluminum conductors, XHHW or XHHW-Z insulation equivalent to Alcan Stabiloy 8000 series. All wire to be used shall be new manufactured within the last 6 months.

C. Conductors #10 AWG and smaller shall be solid. #8 AWG and larger shall be stranded.

D. Each conductor shall bear easily readable markings along entire length, indicating size and insulation type. Dates of manufacturer shall be submitted to Architect/Engineer upon request.

E. Insulation on conductors #8 AWG and smaller shall be suitably colored in manufacturing.

F. Insulation on service and feeder conductors shall be 600 volt type THW, or THWN, unless code requires a different type.

G. Branch circuit conductors shall be minimum #12 AWG, with 600 volt type THWN insulation, unless code requires a different type.

H. Conductors in any location subject to abnormal temperature shall be furnished with an insulation type suitable for temperature encountered.

I. Where no indication is made of wire size (including that noted in panel schedules), the conductor shall be of N.E.C. size to match its overcurrent protective device, but in no case smaller than #12 AWG unless specifically called for.

J. Control and signal conductors shall be type and size indicated in those sections of the specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Joints in conductors #10 AWG and smaller shall be made with approved twist-on type connectors as manufactured by T & B, Ideal, or approved equivalent.

B. Joints in conductors #8 AWG and larger shall be made with mechanical pressure type connectors or lugs.

C. Circuit joints may not be made up on terminal screws of wiring devices. Make circuit joints as above, and connect single leads to device terminals.

D. Conductors shall be labeled within all junction boxes, etc. using plastic "punch" tape, identifying the conductors according to panel and circuit numbers.

E. Where connected under screw or bolt heads, stranded wire shall be fitted with a lug of proper size. Make solid conductor loops clockwise so as to be forced closed as screw is tightened. Only one solid wire loop may be held under a single screw.

F. Make all connections tight. Torque-tighten all connections to lugs per manufacturer's and UL requirements.

G. Wires within panelboards, terminal cabinets, and similar equipment shall be neatly squared and "bunched" together and held so with plastic ties at several places.

H. Where paralleling of conductors is shown for feeders or service entrance, it is absolutely required they be exactly the same length between points of bonding together.

I. Where aluminum feeders are used, conductors shall be terminated with crimp compression type connectors.

3.2 COLOR CODING

A. All wiring shall be color coded.

B. On 120/208V, 3 phase, 4 wire power systems, conductors shall be color coded black (Phase A), red (Phase B), blue (Phase C), and white (Neutral). On 277/480V, 3 phase, 4 wire power systems, conductors shall be color coded brown (Phase A), orange (Phase B), yellow (Phase C) and natural gray (Neutral).

C. Ground conductors on all systems shall be green. Isolated grounds shall be color coded green with yellow stripe.

D. Conductors #8 AWG and larger may be identified with two or more bands of proper color plastic tape applied near each termination. Painting of wire will not be acceptable.

E. Unless noted otherwise, or another arrangement is approved by the Engineer, busses in panels and switch gear shall be considered "A", "B", and "C" from left to right, top to bottom or front to back when facing equipment.

F. Control and signal wiring shall not use the above named colors except green for grounding. Any other colors or striping may be used but the coding shall provide same color or striping between any two terminals being joined.

G. "Travelers" in switching circuits shall be of same color as phase conductors serving the circuits.

3.3 WIRING METHOD FOR BRANCH CIRCUITS

A. Unless shown differently, single-phase circuiting shall be limited to one neutral per raceway (a maximum of three different phase wires but with a single neutral in any case). Three-phase circuits shall be limited to one circuit per raceway (three different phase wires and a neutral if needed).

B. In "3 wire" and "4 wire" branch circuits, a neutral shall not serve more than one circuit tied to the same phase. The neutral carrying all or any part of the current of any specific load or run shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current. No split neutrals permitted.

C. Circuits shall be connected to panels as shown in the panel schedules.

D. Under the above requirements and with required color coding system, no feeder or branch circuit raceway will contain more than one wire of the same color, except for switch legs and control circuits.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Grounding and bonding of the electrical system shall be provided in accordance with requirements of the National Electrical Code, and the requirements of these specifications and the drawings.

B. Contractor shall note that not all required grounding conductors are specifically noted on the drawings or in the schedules or specifications.

C. All feeders and branch circuits shall be provided with grounding conductors separate from the conduit system.

PART 2 - PRODUCTS

2.1 GROUNDING CLAMPS, BUSHINGS, ETC.

A. Materials shall be as manufactured by T & B or approved equivalent.

B. Clamps for attachment of grounding conductors to water pipes, etc. shall be of bronze or brass, with conduit hub with insulated bonding bushings and compression type lugs.

2.2 GROUNDING CONDUCTORS

A. Grounding conductors shall be sized in accordance with the requirements of the NEC, or as noted on the drawings or specified herein.

B. Grounding conductors shall be of copper. Insulation as required by NEC or as noted or specified.

2.3 MADE ELECTRODES

A. Provide "made" grounding electrodes in accordance with NEC Article 250 and as detailed on the drawings.

B. Driven grounding electrodes shall consist of copper clad steel rods not less than 10 feet in length and 3/4 inches in diameter.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. All systems and equipment shall be grounded in accordance with NEC Article 250.

B. All grounding conductors shall be contained within raceway, unless specifically noted otherwise.

3.2 SERVICE GROUNDING

A. Where available on the premises, bond together the following:

1. Metal water pipe.
2. Building metal frame.
3. Concrete encased electrode.

B. Where required by NEC Article 250, and as shown on drawings, provide "made" grounding electrodes to supplement the above. Bond together all available and made electrodes.

C. Service ground clamp shall be attached to cold water main at an accessible point and before its size is reduced. Clamp shall be accessible after construction is complete. Grounding conductor shall be without splice into the service enclosure where it shall be connected to the main service ground buss, and interconnected with system neutral.

3.3 EQUIPMENT GROUNDING, ETC.

A. Ground all fixed and portable appliances and equipment connected under this contract with a green grounding conductor, or metal conduit. The ground wire shall be carried inside the raceway or flex from equipment to ground bus in the panel. Connect at both ends with suitable lugs.

B. Each grounding type receptacle shall have a green ground wire from its grounding terminal to the ground bus in the panel, or to the nearest grounding portion of the raceway system. Ground wire shall be sized by NEC with #12 AWG minimum.

C. Any feeder raceway anywhere in the system which enters a box or cabinet through part of a concentric knockout shall be fitted with a bonding bushing and jumper. The jumper shall be sized by NEC Table 250-122 and be lugged to the box.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Full and proper support shall be provided for all items of electrical equipment, raceway, etc.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials used shall be good quality, made of steel or of other non-corroding material.

B. Inserts in masonry shall be lead, plastic, or fiber type, installed in drilled holes. Lead only shall be used for exterior locations or for interior locations subject to moisture.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment and flat raceways attached to outside walls or interior walls subject to permanent moisture shall be shimmed out with non-corrodible material so as to provide 1/4" air space between wall and equipment or raceway.

B. All materials, whether exposed or concealed, shall be firmly and adequately held in place. Fastening and support shall afford safety factor of three or higher.

C. All fixtures, raceways, equipment shall be supported from the structure. Nothing may be supported on suspended ceilings or ceiling hangar wires unless definitely noted otherwise on the Drawings or specifically permitted by the Architect/ Engineer.

D. Fixtures shall be supported with (minimum) 10 gauge steel wire, (independent of ceiling support wires) or with threaded steel rods, adjusted as necessary to level fixture. For troffer fixtures, use minimum of two supports for each opposite corner. Use one support for downlights and exit signs. See architectural ceiling plans for rated ceiling system fixture support requirements.

E. Where installed recessed in grid type ceilings, attach each fixture to grid with minimum of two "earthquake clips" or other approved method. This requirement is in addition to dedicated support as described in "D" above.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Provide a complete system of raceways for the installation of wiring as indicated by applicable codes.

B. All wiring shall be installed in raceways unless specifically noted otherwise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal raceway system components shall be as manufactured by G.E., Kaiser, Republic, T & B, or other approved manufacturers.

B. Non-metallic raceway system components shall be as manufactured by Carlon, Queen City Plastics, or other approved manufacturers.

2.2 APPLICATIONS

A. Raceways shall be of metal except as specifically noted, or where non-metallic raceway is permitted by these specifications.

B. In non-patient care areas: Use heavy wall PVC or asphaltum (1/8” thick) coated rigid metal conduit (RMC) for any conduit run underground or in poured concrete. In general, non-metallic Schedule 40 PVC raceway will be permitted for use underground or in poured concrete (including panel feeders, branch circuits, etc.) provided all 90 degree E11s up out of floor are heavy wall rigid metal conduit or pvc shall be wrapped with expansion joint material through the slab penetration. Non-metallic raceways will not be permitted for any exposed work for raceways in ceiling spaces, etc. In patient care areas: All parts of the raceway system including boxes and conduits shall be metal and grounded per NEC 517. Underslab raceways shall be wet-location listed.

C. Use electric metallic tubing (EMT) for most other general applications unless otherwise noted.

D. Flexible conduit for appropriate applications. Galvanized type for dry locations. Liquid-tight type for wet locations, or as noted. Flexible conduit shall be minimum 1/2" diameter. Liquid-tight flexible metal conduit shall be used for final connection to all motors, transformers, and other rotating or vibrating equipment. Flexible metal conduit shall be used for final connection to fluorescent lighting fixtures mounted in or on suspended ceilings, and similar applications. Metal-clad cable systems (MC Cable) may be used for all branch circuits rated 30 amperes or less in concealed, dry locations or above bottom chord of roof joists.

E. No raceway may be exposed in any finished space unless specifically so approved, in written form, prior to rough-in.

F. Raceways exposed in finished spaces shall be of an appropriate type "wiremold" type surface raceway or approved equal.

G. Minimum metal conduit size shall be 1/2" (interior) and 3/4" (exterior) for premises wiring system.

2.3 COUPLINGS, CONNECTIONS, ETC.

A. EMT couplings and connectors shall be steel set screw type.

B. Flexible conduit connectors shall be T & B "Tite-Bite" type or approved equivalent, with insulated throats. "Anti-short" bushings shall be used at all motor connections.

C. "Split" or "Erickson" couplings shall be manufactured by O.Z. or approved equivalent.

D. Expansion couplings shall be manufactured by O.Z. or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Heavy wall intermediate metal conduit to be made up with full threads, to which a conductive pipe compound (T & B Kopr-Shield or equal) has been applied, and butted in couplings.

B. Underground runs outside building footprint shall have minimum of 24" cover, filled and tamped in 6" layers. An 8" wide, yellow warning tape reading "Danger Electrical Conduits" shall be provided for each underground conduit run. Bury maximum 12" below finished grade entire length of conduit run.

C. Support conduit as required by code.

D. All raceways shall be concealed unless specifically shown or approved otherwise.

E. Make all cuts square. Remove any burrs by reaming.

F. EMT shall be attached to boxes or enclosures with approved couplings only.

G. EMT and IMC shall be attached to boxes or enclosures with flanged connector and locknuts with insulating bushing.

H. All hard raceways both exposed and concealed shall be run at right angles, either parallel or perpendicular to building lines. Flexible conduit may be run point-to-point only in concealed locations, but must be installed in a neat, workmanship-like manner, that is easily traced. Random, sagging runs shall not be allowed.

3.2 SLEEVES AND PENETRATIONS

A. Electrical Contractor shall provide sleeves and openings for raceways penetrating exterior walls, fire rated partitions, and roofs. Provisions for all such penetrations shall be as approved by the Architect/Engineer.

B. For any raceway passing through an exterior wall, above or below grade, provide appropriate sleeve and water proofing. Fill space between conduit and sleeve with appropriate compound (eg. lead and oakum) and then apply caulking compound - Thiocaulk or approved equivalent - flush finished surfaces.

C. For raceways penetrating floor slabs, smoke partitions, and other fire-rated walls, provide UL listed penetration protection system as approved by the Architect/Engineer. Sealing compound used shall provide same fire rating as barrier being penetrated.

D. Conduits penetrating roof surfaces for purpose of connecting to mechanical equipment (eg. rooftop HVAC units, exhaust fans, etc.) shall utilize openings, curbs, etc. provided for the equipment where possible.

E. For raceway penetrations through roof (except as described in item D above), contractor shall provide appropriate prefabricated roof curb assembly**,** pate pipe assembly with boots, or equal method as approved by Architect/Engineer and roofing subcontractor.

F. Provide suitable UL listed and approved conduit seals on all runs of conduit leaving or passing through refrigerated spaces.

G. After service entrance conduits have been installed, wire pulled, "meggered" and accepted, seal using UL listed and approved duct seal.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Provide and install outlet boxes, junction boxes, pedestal boxes, etc. as required for installation of electrical work, as shown, specified and required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Unless specifically noted or approved otherwise, boxes shall be of metal (steel or aluminum) as manufactured by Steel City, T & B, Raco, Appleton, or approved equivalent.

B. Size all boxes in accordance with applicable NEC articles (eg. 362, 370, 373, 375, etc.).

C. Device boxes shall be section type of 4" square, equipped with plaster rings as required to mount devices.

D. Where appropriate, use masonry boxes as manufactured by Raco.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set all boxes with edges flush with finished surface.

B. Immediately after installation, cover raceways and boxes to prevent entrance of foreign matter, mortar, paint, etc.

C. Contractor shall coordinate with other trades, and shall study the Architectural Plan Drawings, casework drawings, etc. to determine proper placement and mounting heights of all devices.

D. Where not shown or required otherwise, the following standard mounting heights and positions shall apply:

1. Switch boxes 48" from finished floor to center. Boxes beside doors shall be mounted so edge of trim plate is 2" from edge of door trim on strike side.
2. Telephone boxes 18" from finished floor to center and vertical. Boxes for wall phones shall be 60" from finished floor and vertical.
3. Panelboard enclosures 6'-4" (plus or minus 4" in concrete block construction) from finished floor to top of can.
4. Fire alarm pull stations 46" from finished floor to center.
5. Fire alarm signal devices 6'-8" to bottom of strobe lens - or 4" below ceiling to top of device for areas with ceilings lower than 7'-0".
6. Receptacle boxes 18" from finished floor to center, mounted vertically.
7. When multiple switch/fire alarm pull stations are mounted side-by-side on same wall, all devices shall be mounted at the same height (does not include receptacle/telephone).

E. Where receptacles, telephone outlets, etc. occur over counter tops, etc., install box so that device is centered 6" above counter or backsplash, or higher if required to coincide with blockwork coursing. Carefully coordinate so that trim plates are completely clear of backsplashes, etc.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Dry type two winding transformers.

1.2 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver transformers individually wrapped for protection and mounted on shipping skids.

B. Accept transformers on site. Inspect for damage.

C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 TWO-WINDING TRANSFORMERS

A. Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, ratings as indicated.

B. Insulation system and average winding temperature rise for rated KVA as follows:
1. 16-500 KVA: Class 220 with 150 degrees C rise.

C. Winding Taps:
1. Six - 2 1/2%, two FCAN and four FCBN.

D. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

E. Mounting: Transformer shall be floor mounted in accordance with manufacturer recommendation. Provide 4" high concrete housekeeping pad sized as required.
1. As an alternate, units may be trapeze mounted supported directly from the building structure using 1/2" rods with steel channels. Provide vibration isolators for each rod. Obtain Architect's approval prior to trapeze installation.

F. Coil Conductors: Continuous windings with terminations brazed or welded.

G. Enclosure: NEMA ST 20; Type 1.

H. Isolate core and coil from enclosure using vibration- absorbing mounts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Set transformer plumb and level.

C. Use flexible conduit, 2 ft. minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

D. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

E. Provide grounding and bonding in accordance with NEC.

3.2 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install power distribution panelboards as scheduled on the drawings and as herein specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Panelboards shall be manufactured by Square D or approved equivalents by Siemens, General Electric or Cutler-Hammer.

B. Panelboard types indicated on the drawings are those of Square D, and the standard construction features of those types shall be considered as minimum requirements, with additional requirements as specified herein.

2.2 CONSTRUCTION FEATURES

A. Types, sizes, capacities, and characteristics shall be as shown on riser diagrams or in schedules on the drawings.

B. Equipment shall be built on NEMA Standards where such standards exist.

C. Housing shall be constructed of galvanized sheet steel and shall be securely fabricated with screws, bolts, rivets, or by welding. Housings for panelboards shall be a minimum 20" wide and 5-3/4" deep, unless noted otherwise. Top or bottom gutter space shall be increased 6" where feeder loops through panel. Housing dimensions shall not exceed those of specified panelboards without written approval of Engineer.

D. Covers shall be constructed of high grade flat sheet steel with:
1. Door flush with face and closed against a full inside trim stop. Hinges shall be inside type.
2. A flush latch and tumbler type lock, so panel door may be held closed without being locked. All such locks on same job shall be keyed alike. Furnish two keys with each lock.
3. Four or more cover fasteners of a type which will permit mounting plumb on box. Cover shall also have inside support studs to rest on lower edge of can while being fastened. For flush mounted panelboards, cover fastener hardware shall be concealed behind the hinged door.

E. A means of readily adjusting projection of panel interior assembly with all connections in place shall be provided. A method requiring stacking of washers is not acceptable.

F. Interior trim shall fit neatly between interior assembly and cover leaving no gaps between the two. Where (2) section panels are specified, both panel trims shall be the same height.

G. Busses shall be of 98% conductivity copper.

H. Minimum interrupting capacity rating of any panelboard assembly shall be 10,000A (120/208V systems), 14,000A (277/480V systems). Furnish panelboards with higher rating where so noted or where evidently intended by specification of circuit breaker frame types, etc.

I. Where drawing schedules indicate spaces for addition of future circuit breakers, furnish all necessary bussing, brackets, hardware, etc.

J. Breakers in distribution or branch circuit panelboards shall be physically arranged in locations shown in panel schedules on the drawings. They shall be connected to the phases as shown.

K. All panels shall be supplied with copper ground bars.

L. All circuit breakers shall be bolt-on type.

M. All 120V, 15 or 20 amp breakers serving receptacles located in bedrooms shall be arc fault interrupting type.

N. Service equipment shall be labeled "UL approved for Service Entrance Use."

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment, either surface or flush mounted, shall be perfectly plumb and level.

B. All openings in boxes, cabinets, or gutters shall be cut or sawed with tools made for that purpose. Burning of openings is absolutely unacceptable.

C. All unused openings shall be closed.

D. Only one solid wire is allowable under a screw. Provide an approved lug for connecting stranded wire or more than one solid conductor.

E. Front edges of all flush mounted panel housings shall be exactly flush with finished wall.

3.2 LABELING

A. For branch circuit power panelboards, directory cards shall be neatly typed to indicate load served by each breaker or fuse. Directory cards shall indicate circuits in a manner analogous to the physical circuit breaker arrangement (eg. odd numbered circuits in one column, even numbered circuits in another). Mount cards behind heavy plastic shields in metal frames. Mark spares and spaces in pencil only.

B. Next to each breaker within main or distribution panel boards, attach a label indicating load served. Wording shall be as shown on its diagram or schedule on the drawings.

C. Attach a label indicating panel designation centered above the door in each panelboard. Add voltage, for example, "DPI - 120/ 208V." Use black letters on white background.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Contractor shall furnish and completely install lighting switches, convenience outlets, special purpose receptacles, etc. along with appropriate outlet boxes, trim plates, etc. as indicated on the drawings and schedules, and as herein specified.

B. Where connection to an item of equipment is required under this contract, and where such equipment requires a wiring device (special purpose receptacle) for connection, contractor shall furnish and install the appropriate device, whether or not the device is specifically shown or specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All wiring devices of any one general type (eg. all duplex receptacles, all wall switches, etc.) shall be of the same manufacturer and shall match throughout.

B. All wiring devices (i.e., receptacles and switches) and associated trim plates shall be manufactured by General Electric, Hubbell, P & S, Arrow, or approved equivalent. Snap switches shall be rated 20 AMP 120-277 volts, 60 HZ, AC. All duplex receptacles shall be rated 15 AMP, NEMA 5-15R, unless otherwise noted.

2.2 WIRING DEVICES

A. Devices shall be specification grade.

B. Devices unless otherwise noted or approved shall be white in color.

C. Receptacles noted as “WP” (weatherproof) shall be UL listed for “in-use” operation in the weather.

2.3 TRIM PLATES

A. All trim plates shall be of same style, matching throughout project.

B. Unless noted otherwise, trim plates shall be smooth white nylon. All plates shall look identical except for required openings and sizes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Devices shall be mounted tightly to boxes, and be adjusted plumb and level.

B. Where two or more devices are indicated for adjacent installation, they shall be trimmed with gang type plates.

C. Ground each receptacle by means of a separate code size ground wire (#12 minimum) connecting the receptacle ground terminal to the branch circuit panel ground bus. The conduit system shall not be the code required return ground path.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. This section includes low voltage disconnect switches.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 600 AMPERES AND LESS

A. Quick-make, quick-break type in accordance with UL98, NEMA KS 1 and NEC.

B. Shall be capable of accepting UL and NEMA standard fuses.

C. Shall be rated at 100,000 A.I.C. when provided with the proper rated fuses.

D. Shall have the following features:
1. Switch mechanism shall be the quick-make, quick-break type.
2. Copper blades, visible in the OFF position.
3. An arc chute for each pole.
4. External operating handle shall indicate ON and OFF position and shall have lock-open padlocking provisions.
5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.
6. Fuse mounting for the size and type of fuses specified. Furnish switches completely fused. Furnish a complete set of spare fuses for each switch being installed. Provide additional sets of spare fuses to constitute not less than two complete sets for the type, size, and rating of each set installed. Deliver the fuses to the Owner prior to the final inspection.
7. Enclosures:
    a) Shall be the NEMA types shown on the drawings for the switches.
    b) Where the types of switch enclosures are not shown, they shall be the NEMA types which are most suitable for the environmental conditions where the switches are being installed.

E. Shall be heavy duty, Type HD, and horsepower rated as required.

2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 600 AMPERES AND LESS

A. Shall be the same as Low Voltage Fusible Switches rated 600 amperes and less, except it shall not accept fuses.

2.3 FUSES

A. Provide dual element, time delay fuses equal to Fusetron RK-5 unless otherwise noted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown on the drawings.

B. Provide fusible switches and fuses as required by nameplates of equipment served.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide a factory built, prototype tested, production tested, engine generator system as specified herein, shown on the drawings, and as required for the service All control and power wiring shall be by the contractor. All miscellaneous equipment, supports, etc. necessary for a complete, operable system shall be provided as required by the contractor.

B. The standby system to include automatic transfer switch, engine/generator, controls, batteries, silencer, exhaust flexible connection, rain cap, weatherproof enclosure accessories, tests, documents, and manufacturer start-up services needed to meet the performance requirement of this section.

C. Equipment to be manufactured by a single manufacturer who has been regularly engaged in the production of engine/generator sets, transfer switches and controls for a minimum of ten years, as to provide a single source responsibility to the owner for warranty, parts and service.

D. Manufacturer to have local representatives who can provide factory trained service personnel, with adequate stock of replacement parts and can provide technical assistance for the entire emergency electric generation system. Manufacturer to provide printed literature and brochures of the specific equipment proposed.

E. Testing: Testing to consist of factory prototype model tests per NFPA 110, factory production model test, and certified tests as follows:
   1. Prototype testing shall be performed on separate prototype models, not on the equipment sold. Certification shall be submitted certifying the following tests have been performed:
      a. Maximum power level (kW).
      b. Maximum motor starting capacity (kVA).
      c. Structural soundness.
      d. Torsional analysis per MIL-STD 705B, Method 504.2. Calculations based on engine and generator separately are not acceptable.
      e. Engine-alternator cooling air flow.
      f. Alternator temperature rise.
      g. Harmonic analysis and voltage wave form deviation per MIL-STD 705B, Method 601.4.
      h. Single phase short circuit test.
      i. Failure mode test for voltage regulator.
      j. Endurance test and rated load and speed.
   2. Factory production model tests shall be made, prior to shipment, of all system components. These tests shall be performed under rated load and power factor (unity power factor is not acceptable). Other tests shall include:
      a. Single step load pickup per NFPA 76A.
      b. Transient response and steady state governing.
      c. Functional compatibility between generator set controls and transfer switch controls.
   3. Field tests: Manufacturer's representative of standby system to be present at the time of start-up for testing and owner orientation. The tests to include:
      a. Two hours at 100 percent of generator set rating.
      b. Simulated power failure tests utilizing the transfer switch and its time delays and the building load (two hours).

c. A fifteen minute engine/generator cool down period without load before shutdown.
d. All testing shall include records at fifteen minute intervals of water temperature, oil pressure, ambient air temperature, voltage, current, frequency, kW and power factor. Provide test data in triplicate, to the Owner's Agent.

F. Warranty: Three year, or 900 hours of operation, whichever occurs first, from the time of initial start-up. Warranty shall be supplied by the system manufacturer.

1.2 QUALITY ASSURANCE

A. UL listed.

1.3 SUBMITTALS:

A. Submit product data sheets in accordance with Electrical General Requirements. Submittal data to include equipment rating and selected options.
1. Shop drawings to include detailed installation plan and elevation drawings to scale indicating all components.
2. Submit proposed concrete base requirements.

B. Submit operation and maintenance data in accordance with Electrical General Requirements. Required routine maintenance actions shall be clearly identified.

C. Submit names and addresses of at least one qualified service agency.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver with UL labels and bearing manufacturer's name.

B. Deliver in manufacturer's original unopened and undamaged crates, or packages.

C. Store and handle so as not to subject material to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturer:

A. Onan, Caterpillar, Kohler or Generac are approved.

B. Products of other manufacturers with single manufacturer responsibity meeting all requirements of the plans and specifications will be considered. Provide submittals with all protoype and production test data, weights, dimensions, ratings, model numbers, interconnection wiring diagrams, and internal wiring diagrams, and schematics of all major components. Data to be submitted with section and paragraph identification same as items specified. Basis of design is Generac Guardian Series 10kW #006051-1 (10kw), or approved equal.

2.2 MATERIALS

A. Engine-Generator Set:

1. General: This system shall include one engine-generator set, kilowatt rated as indicated on the drawings at 1.0 power factor, 60 Hz, single phase, three wire, on a standby basis.
2. The generator set shall be mounted on a suitable steel base for mounting on a level surface. Vibration isolators to be provided between engine-generator and skid.
3. The engine shall be 4 cycle, 1800 to 3600 rpm.
4. The engine shall be stationary, cooled, LP gas.
5. Engine equipment to include the following:
    a. Remote two wire negative ground starting system. Positive shift, gear engaging starter. Two independent methods to disconnect the starting circuit upon engine starting. Starting system 24 VDC.
    b. Positive displacement, mechanical full pressure lubrication pump, oil filters, oil level indicator, oil drain valve with hose extension.
    c. Primary and secondary fuel filters with replaceable elements, electric fuel transfer pump, automatic fuel shut-off, replaceable dry element air cleaner, all mounted on engine.
    d. Replaceable dry element air cleaner.
    e. Electronic governor with electric actuator. Speed droop externally adjustable from isochronous to five percent.
    f. Low coolant level shut-down and high engine temperature shut-down.
    g. Water temperature gauge, oil pressure gauge, battery charging ammeter.
    h. Alternator with voltage regulator.
6. Engine Cooling System:
    a. Provide a complete and operating unit mounted radiator system for the engine/generator, radiator to have a capacity as recommend by the engine generator manufacturer.
    b. Coolant shall be a solution of 50 percent ethylene glycol and 50 percent water.
7. Fuel Systems:
    a. Provide pad-mounted fuel tank, double wall construction with leak detection.
    b. Fuel solenoid valve.
    c. Flexible fuel lines for connection to engine.
    d. Provide capacity as required for full load operation for 4 hours, minimum.
8. Generator:
    a. Generator to be single bearing, self aligning, four pole, synchronous type, revolving field, with amortisseur windings, direct drive centrifugal blower for proper cooling, solid state voltage regulator, with brushless rotating rectifier exciter system. No brushes allowed. Generator directly connected to the engine flywheel housing, driven through a flexible coupling to ensure proper alignment. Gear driven generators are not acceptable. Class F insulation.
    b. Frequency regulation to be isochronous from no load to rated load. Voltage regulator solid-state design and shall function by controlling the exciter magnetic field between stator and rotor to provide no load to full load regulation within $\pm$one percent of rated voltage during steady-state conditions. The generator set and regulator must sustain at least 90 percent of no load voltage for ten seconds with 250 percent of rated load at near zero power factor connected to its terminals. A rheostat shall provide a minimum of $\pm$five percent voltage adjustment from rated value.
    c. The alternator, exciter, and voltage regulator designed and manufactured by the generator set manufacturer so that the characteristics will be matched to the torque curve of the

prime mover. System shall provide automatic voltage reduction if the load demand exceeds the engine capacity to prevent engine stalling and saturation of magnetic components. Systems that routinely select a linear-type (straight-line), constant volts/hertz characteristic, without regard for the engine power and torque characteristics, will not meet this specification.

e. Exciter single phase, full-wave, rectified, with heavy-duty silicon diodes mounted on the common rotor shaft and sized for maximum motor starting. Systems using three-wire solid-state control elements (such as transistors or SCR's) rotating on the rotor shaft shall not be acceptable.

9. Engine-Generator Control:
   a. Provide a lighted, unit mounted, control console, shock mounted, wired and tested by the generator manufacturer. Terminals identified as to their function, or purpose. Control terminals in generator control panel and automatic transfer switch to be identical for ease of connection by the contractor.
   b. Control console shall include the following:
      1) Engine controls and gauges.
      2) Three position selector switch (Run-Stop-Remote).
      3) Contacts for engine start and stop.
      4) Engine monitor (solid-state) with fault lights and external alarm terminals for overcrank, overspeed, high coolant temperature, low oil pressure, low fuel, and low engine coolant temperature. Engine shutdown provided for overcrank, overspeed, high coolant temperature and low oil pressure. Ground fault indication. Pre-alarms shall be provided for high coolant temperature and low oil pressure. Contacts shall be provided for remote annunciation of the above.
      5) Provide an adjustable solid-state cycle cranker which shall disconnect the starting control after 60 seconds and a minimum of three cranking attempts.
      6) Solid-state voltage regulator with voltage adjusting rheostat.
      7) Manual reset field circuit breaker.
      8) Running time meter, AC voltmeter, (Dual range - indicating all voltages), AC ammeter (dual range), voltmeter/ammeter phase selector switch with OFF position and frequency meters. AC meters shall be 3-1/2 inch, two percent accuracy.
10. Auxiliary Equipment:
   a. Heavy duty lead acid batteries with battery rack, as recommended by the engine manufacturer, 24 VDC.
   b. Battery charger.
   c. Vibration isolators, spring type, sized as recommended by generator manufacturer, minimum of six.
   d. Critical grade silencer with calcium silicate insulation, minimum 12”.
   e. Remote annunciator, with the following alarms:

Alarm	Lamp Color	Audible
High battery voltage	Red	No
Low battery voltage	Red	No
Normal battery voltage	Green	No
Generator running	Green	No
Normal utility power	Green	No
EPS supplying load	Green	No
Pre-low oil pressure	Yellow	Yes
Low oil pressure	Red	Yes

Pre-high coolant temp.	Yellow	Yes
High coolant temp.	Red	Yes
Low engine temp.	Red	Yes
Overspeed	Red	Yes
Over crank	Red	Yes
Not in auto	Flashing Red	Yes
Battery charger malfunction	Red	Yes
Low fuel	Red	Yes
Ground Fault	Red	Yes

11. Enclosure: Reinforced sheet steel, manufacturer's standard finish. Removable access panels shall have provisions for padlocking. Where generator produces noise levels that do no meet meet local noise ordnances, provide skin-tight sound attenuated enclosure.

B. Transfer Switch:
   1. General: The automatic transfer switch to be designed, built, tested, furnished and warranted by the manufacturer. The transfer switches to be provided with three year warranty.
   2. Rating: Transfer switch UL listed per Standard 1008 and suitable for use in emergency and legally required standby systems in accordance with ANSI-CI and NFPA 76A.
   3. Construction: NEMA 1 enclosure with key locking front door. Operation mechanical break before make approved for manual operation under full load by permanently installed operating handles. Switches using magnetically operated contactors not acceptable. Provide unit with transparent covers over main contacts for visual inspection. Main contacts high-pressure silver also with arc chutes with covers for extinguishing arcs and preventing interphase flashover. Provide auxiliary contacts (one normally open and one normally closed), rated minimum of ten amperes, 240 volts on both normal and energy side. Transfer switch constructed to accept program transition feature as field modification.
   4. Controls: Solid-state voltage sensors and time delay modules with gold contacts plug-in type. All relays plug-in type. Solid-state voltage sensors to monitor all phases of both the normal and emergency power sources and be adjusted and set as recommended by the engineer for pick-up and drop-out. Adjustable time delays with ranges as follows:
      a. Engine starting 0-6 seconds
      b. Transfer 0-120 seconds
      c. Retransfer 0-32 minutes
      d. Engine stop 0-8 minutes
   5. The operating power for transfer and retransfer to be from the engine generator set. Controls to automatically retransfer to the normal source if the emergency source fails.
   6. Provide control mode status indicators, consisting of L.E.D.'s to indicate sequence of functions and assist in determining the source of a malfunction as follows:
      a. Source OK
      b. Two-wire run
      c. Source 2 OK
      d. Timing for transfer
      e. Transfer command
      f. Timing for transfer
      g. Retransfer command
      h. Timing for stop

7. Provide "normal" and "emergency" lamps on transfer switch cabinet and a key operated selector switch for the following functions:
   a. Test Switch: Simulate power failure including testing with or without load.
   b. Normal: Normal operating position. Also, returns load to normal source after test time delays.
   c. Retransfer: (Momentary) overrides time delays for immediate return to source.
   d. Starting dry contacts gold type, Form C.
8. Accessory Items:
   a. Exerciser clock (seven day).
   b. Ten amp, 24 volt SCR regulated float charger with battery charging ammeter and fuse protection.
   c. Auxiliary set of contacts for chiller lockout control, control wiring by mechanical contractor.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine all areas to receive engine generator set, transfer switches and coordinate work with other trades. In case of question consult engineer prior to proceeding with work.

3.2 TESTING

A. Engage an independent testing agency to perform tests on the completion of the installation. Use instruments bearing records of calibrations within the last 12 months, and for making positive observation of text results.

B. Include the following:
   1. InterNational Electrical Testing Association Test: Perform each and visual and mechanical inspections and electrical and mechanical test stated in InterNational Electrical Testing Association's NETA ATS for emergency engine generator sets. Certify compliance with test parameters.
   2. Battery Test:
      a. Measure charging voltage and voltages between available battery terminals for full charging and float charging.
      b. Check electrolyte and specific gravity under both conditions.
      c. Test for contact integrity of all connectors.
      d. Perform an integrity load test and capacity load test for the battery.
      e. Verify acceptance of charge for each element of battery after discharge.
      f. Verify acceptance measurements are within manufacturer's written specifications.
   3. Battery Charger Test: Verify specified rates of charge for both equalizing and float-charging conditions.
   4. System Integrity Tests: Methodically verify proper installation, connection and integrity of each element of engine generator system before and during system operation. Check air, exhaust and fluid leaks.

C. Retests: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.3 INSTALLATION

A. Install all equipment in strict accordance with manufacturer's written instruction. Entire installation to be under the supervision of equipment manufacturer's authorized factory representative.

B. Testing and adjusting: See other parts of this section for specific requirements.

3.4 TRAINING

A. Provide two 4-hour on-site training session for maintenance staff covering equipment operation and maintenance including, but not limited to, the generator set and transfer equipment.

B. Schedule training with at least 7 days advance notice.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of Section 26 0000 govern the work specified in this section.

1.2 DESCRIPTION OF WORK

A. The work includes the design and installation of a lightning protection system meeting all the criteria set forth in NFPA 78 and that required for UL Master Label for the protection of the facility.

B. Service entrance transient voltage surge suppression (TVSS) shall be included as specified.

1.3 QUALITY ASSURANCE

A. The lightning protection system shall conform to the following requirements:
1. National Electric Code.
2. Lightning Protection Institute Installation (LPI) Code LPI-175.
3. Underwriter's Laboratories Lightning protection Components Code 96 (UL).
4. Underwriter's Laboratories Master Label Code 96A (UL).
5. National Fire Protection Association Standard 780 (NFPA).
6. Underwriter's Laboratories Standard for Transient Voltage Surge Suppressors 1449, 2nd Edition (UL).
7. National Electrical Manufacturer's Association Low Voltage Surge Protective Devices Standard LS1 (NEMA).

B. Underwriter's Laboratories Master label shall be furnished affixed as required.

C. The system shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest approved design.

1.4 SUBMITTALS

A. Shop Drawings: Submit the type, size, and locations of all equipment, grounds, and cable routing on a set of dimensioned drawings prepared by the Contractor to the same scale as the contract drawings.

B. Manufacturer's product data.

C. UL Master Application Form and LPI Forms 175A and 175B.

PART 2 – PRODUCTS

2.1 GENERAL

A. All material and equipment shall be UL approved and labeled with each terminal bearing an "A" label and all main conductors bearing a "B" label at 10-0" intervals.

B. All equipment shall be the product of a single manufacturer and of a design and construction to suit the application for which it is to be used, in accordance with accepted industry standards, LPI, NFPA and UL Code requirements.

2.2 TRANSIENT VOLTAGE SURGE SUPPRESSOR

A. Surge Protective Device Description: Provide the following features and accessories:

1. Integral LED indicator lights showing proper operation of each module, visible without opening the enclosure door.
2. Form C contacts for remote monitoring.
3. Utilizing metal oxide varistor technology.
4. Integral disconnect switch rated at a minimum of 100 KA interrupting capacity.
5. Including thermal protection for each component, which is continuously monitored.
6. Nema 1 style enclosure suitable for indoor installation.
7. Minimum 30dB filtering attenuation (50KHz to 100MHz).

B. Single Impulse Surge Current Capacity shall be at least as follows:
1. L-N: 100 kA
2. L-G: 100 kA
3. L-L: 100 kA
4. N-G: 100 kA

C. Clamping voltage (277/480 volt system) minimums: L-N, N-G: 800 volts; L-G: 1000 volts; L-L: 1500 volts.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Installation shall be accomplished by an experienced installer employed by the approved manufacturer.

B. All equipment shall be installed in the most inconspicuous manner possible. System shall be installed complete with cable network on the roof, air terminals, splices, and bonds with cable downleads routed in conduit to ground.

C. All conductors shall be copper with bronze connections. Equipment shall not be connected to or allowed prolonged contact with aluminum surfaces except by a UL approved bimetal transition fitting.
1. Where aluminum or aluminum alloys are used in surfaces which shall support lightning system conductors and components (i.e., aluminum roofs or siding), those portions of conductors and components shall also be aluminum. Once those portions are no longer supported by aluminum surfaces, provide bimetal transition to copper for the remainder of the system.

D. Air terminals and cable fasteners shall be located and spaced in compliance with LPI and UL requirements.

E. See Architectural, Mechanical, Plumbing and Electrical Plans for locations of all equipment requiring bonding and air terminal protection.

3.2 COORDINATION

A. Coordinate lightning protection with all trades work to insure a correct, neat, and unobtrusive installation.

B. Provide a tight, mechanical sound bond to the main water service to assure inter-connecting with other building ground systems.

C. Verify that the TVSS equipment is installed at the service entrance in accordance with the manufacturer's written recommendations.

3.3 TESTING

A. Upon completion of installation of lightning protection system, test ground resistance with a Megger ground tester or equal. Ground resistance shall be a maximum of 5 ohms.

3.4 LABEL

A. Secure and deliver a UL Master label to the Owner.

END OFSECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of Section 26 0000 govern the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Service entrance surge protective devices (SPDs) shall be included as specified.

1.3 QUALITY ASSURANCE

A. The system shall conform to the following requirements:
   1. National Electric Code Article 285.
   2. Underwriter's Laboratories Standard for Surge Protective Devices, UL 1449 Third Edition (UL).

B. The system shall be the standard product of a manufacturer regularly engaged in the production of Surge Protective Devices and shall be the manufacturer's latest approved design.

1.4 SUBMITTALS

A. Manufacturer's product data shall include UL 1449 Listing documentation verifying Short Circuit Current Rating (SCCR), Voltage Protection Ratings (VPRs) for all modes, Maximum Continuous Operating Voltage rating (MCOV), I-nominal rating (I-n), Type 1 Device Listing. UL data and visual inspection takes precedence over manufacturer's published documentation.

B. Submittals shall include shop drawings including the manufacturer installation instruction manual and line drawings detailing dimensions and weight of enclosure, internal wiring diagram illustrating all modes of protection in each type of SPD required, wiring diagram showing all field connections and manufacturer's recommended wire and breaker sizes.

C. Upon request, an unencapsulated but complete SPD shall be presented for visual inspection; proprietary technology included. MOV type & quantity shall reflect kA ratings on cutsheets, verification of diagnostic monitoring, thermal & overcurrent protection, etc.

D. Minimum of five (5) year warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Subject to compliance, the following manufacturers are acceptable:
   1. Current Technology
   2. Siemens
   3. SquareD
   4. Advanced Protection Technologies, Inc.
   5. Innovative Technology, Inc.

2.2 RATINGS

A. Every suppression component of every mode noted elsewhere in this specification, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls.

B. Minimum Single Impulse Surge Current Capacity per phase (phase = L-N + L-G) shall be as follows:

Service Entrance or Transfer Switch:	200 kA
Distribution Panelboards & MCC:	100 kA
Branch Panelboards:	60 kA

C. SPD shall provide surge current paths for all modes of protection:
(7-mode) L-N, L-G, and N-G for Wye systems;
(6-mode) L-L, L-G in Delta and impedance grounded Wye systems.

D. UL 1449 Third Edition Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	700 V	700 V	1200 V	700 V
480Y/277	1200 V	1200 V	2000 V	1200 V

E. The SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50 dB at 100 kHz.

F. UL 1449 Third Edition Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

G. SPD shall be UL labeled with 20 kA Inominal (I-n), which is verifiable at UL.com, for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

H. SPD shall be UL labeled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

I. Suppression components shall be heavy duty ‘large block’ MOVs, each exceeding 30 mm diameter.

2.3 FEATURES AND ACCESSORIES

A. Surge Protective Device Description: Provide the following features and accessories:
1. The SPD shall have visual LED diagnostics including a minimum of one green LED indicator per phase and one red service LED, visible without opening the enclosure door.
2. The SPD shall be provided with 1 set of NO/NC Form C dry contacts for remote monitoring.
3. Utilizing thermally protected metal oxide varistors, which are continuously monitored.
4. The SPD shall be provided with an integral disconnect switch when a 3-pole breaker is not available to connect the SPD.
5. Nema 1 style enclosure suitable for indoor installation.
6. SPD shall include an audible alarm with on/off silence function and diagnostic test function (excluding branch).

PART 3 – EXECUTION

3.1 INSTALLATION

A. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60A breaker is not available.
B. At Distribution, MCC and Branch, SPD shall have an independent means of servicing disconnect such that the protected panel remains energized if a 30 A breaker (or larger) is not available.
C. The surge protective device shall be installed per manufacturer's instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
D. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.
E. SPD shall be installed on the load side of the main service disconnect.
F. Verify that the SPD is installed in accordance with the manufacturer's written recommendations.
G. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Contractor shall furnish and install completely the lighting fixtures indicated on the Drawings and as herein specified.

B. All fixtures shall be equipped with lamps.

C. A lighting fixture shall be provided for every lighting outlet indicated. Any omission shall be brought to the attention of the Architect/Engineer before submitting proposal; otherwise, a unit selected by the Architect/Engineer shall be furnished and installed at no additional charge.

PART 2 - PRODUCTS

2.1 FIXTURES AND BALLASTS

A. Fixture types shall be as indicated on the Drawings.

B. Catalog numbers shown on the Drawings are for general identification of fixtures only. All related parts, such as plaster rings, junction boxes, louvers, shields, mounting stems, canopies, connectors, straps, nipples, etc., required to fit them properly to the construction, shall be furnished and installed.

C. Unless noted otherwise, all fluorescent fixtures shall be provided with high power factor, UL approved, ETL approved, and CBM made Class "P" ballast individually fused. Ballasts serving nominal 4 foot fluorescent lamps shall be of electronic type “Rel” Series by Advance or equivalent by G.E., Motorola, Sylvania, or other approved equal. Ballasts for fluorescent fixtures in non-heated areas shall be rated for use at 0 degrees F.

D. Sound ratings shall be Class A, except for ballast sizes which are not available with A ratings, as standard products from any manufacturer. Ballasts which are not available with A ratings shall have the quietest ratings available and shall be brought to the attention of the Architect/Engineer prior to purchasing.

E. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers.

F. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.

G. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.

H. Recessed incandescent fixtures shall be thermally protected in compliance with NEC section 410-65.

2.2 LENSES

A. Shall be 100 percent virgin acrylic prismatic or injection molded as noted in light fixture schedule on the drawings.

B. Flat lens panels shall have no less than 1/8-inch thickness.

2.4 LOUVERS

A. Parabolic louvers shall be nominal 3" deep, low iridescent anodized aluminum finish.

B. Extra ballast cover or other means shall be provided to assure full separation of louver cavity rows within the fixture.

2.5 LAMPS

A. All fluorescent lamps shall be of the energy savings type (T-8 or compact), color as noted in light fixture schedule on the drawings.

B. All incandescent lamps shall be 130 volt type and of the energy savings type noted.

C. HID lamps shall be phosphorus coated unless specified otherwise. "Open rated" lamps shall be used in fixtures without protective lenses.

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractor shall verify ceiling or wall type in or on which each fixture is to be mounted, and shall furnish unit with appropriate trim type, mounting hardware, feed through junction boxes, etc., to fit the construction and maintain proper access to system wiring.

3.2 INSTALLATION

A. Installation shall be in accordance with the NEC, and as shown on the drawings.

B. Align, mount and level the lighting fixtures uniformly.

C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect/Engineer.

D. Lighting Fixture Supports:
1. Shall provide support for all fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling. See also Section 26 05 29 of this specification.

2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

E. Where fixtures are connected to the rigid raceway system by flexible conduit, a green grounding conductor shall be run within the flexible conduit. This grounding jumper shall be connected to the fixture and to the raceway system using screws, bolts, or clips, equivalent to Steel City "G" clip.

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE

A. Contractor shall furnish and install a system of raceways and backboards as indicated on the drawings and as herein specified.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Raceways, boxes, etc. shall be in compliance with the relevant sections of these specifications.

B. Wall outlet shall consist of a standard 2" x 4" x 2-1/2" outlet box, with single device ring. Trim plate shall be standard "telephone" type, to match wiring device trim plates.

C. Telephone equipment boards shall be of size noted or shown on the drawings, and shall be constructed of 3/4" plywood, with finish grade front. Paint board with two coats of gray fire-retardant paint.

D. Provide 3/4" electrical metallic tubing from voice only outlet boxes or 1” electrical metallic tubing from combination voice/data outlet boxes to above accessible ceiling. Provide insulating nylon bushings on all ends of all conduit stubs.

E. Special outlets, floor outlets, etc. shall be noted on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install pull boxes as necessary in all conduits to limit runs to two (2) 90 degree bends (or equivalent) and to 100 feet in length.

B. Leave all spare raceways with 200 lb. test nylon pull cord.

C. Install raceways, boxes, etc. in accordance with relevant sections of these specifications.

D. Coordinate with the telephone utility to provide service conduits extended underground to property line.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

A. Contractor shall furnish and install as directed on the plan drawings, and as herein specified, a complete system of fire alarm and detection equipment.

B. System shall include all devices, wiring, equipment, raceways, etc. required for a complete and satisfactorily operating system, whether or not every such item is specifically shown or mentioned.

C. System components, installation and operation shall be in strict accordance with the Fire Marshal's requirements for fire detection & alarm systems. System supplier shall be required to review the drawings carefully and shall include all devices required to attain Certificate of Occupancy and to notify the electrical contractor of any additional requirements not shown on the drawings so that all labor shall be included in the bid.

D. All fire and smoke detection and alarm systems shall comply with latest applicable editions of NFPA 72 and ADA. They must also comply with State and Local Building Code, including NFPA 1 Fire Safety Code, NFPA 70 National Electrical Code, NFPA 90A Installation of Air Conditioning and Ventilating Systems, Fire Safety Code and NFPA 101 Life Safety Code.

E. The system shall be multiplexed addressable, nominal 24 VDC, non-coded, and fully supervised (including control circuits). All equipment supplied must be listed for the purpose for which it is used, and installed in accordance with any instructions included in its listing. It must also be new, with a warranty (parts & labor) of at least one year from the date of final inspection and acceptable by the State.

F. The system shall be electrically supervised for open or (+/-) ground fault conditions in the detection circuits, the alarm circuits, and the system alarm and trouble relay coils. Removal of any detection device, alarm appliance, system module, or standby battery connection shall also result in a trouble signal. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.

1.2 SYSTEM FUNCTION

A. Upon activation of any manual station, smoke detector, flow switch or other alarm initiating device, the following functions shall occur automatically:
   1. The alarm condition shall be annunciated visually and audibly at the fire alarm control panel. Alphanumeric display shall indicate device type and location of alarm.
   2. The alarm signaling system shall be activated. Upon activation, the alarm signaling shall sound an alarm signal throughout the building via the audible/visual system. This evacuation signal shall sound continuously until

such time as the manual station or automatic detector is restored to normal and the fire command station reset.

3. The alarm condition shall be transmitted to Owner selected, UL listed central monitoring station via dual line digital communicator.

B. Special functions shall be activated as required.

1. At any time (except as defined above) it shall be possible for the operator to transmit an alarm signal.
2. Activation of duct mounted smoke detectors shall cause HVAC shutdown. Coordinate interlock with the mechanical contractor.
   a. Duct detectors shall transmit supervisory signal only and will not activate the evacuation signal system nor notify the fire response service.
   b. Provide a toggle switch override of HVAC shutdown in the fire alarm panel with normal status indicated at the switch.
3. Activation of any alarm shall cause the release of any door hold open devices.
4. Activation of any alarm shall cause the release of any door mag-lock access control devices.
5. Coordinate with the sprinkler system subcontractor as required.
   a. Verify exact location and quantity of all system flow switches and valves to be monitored by the fire alarm system.
   b. Verify requirements for any dry system installation including power connections for air compressor(s) and monitoring of pressure switch(es).

1.3 SYSTEM SUPERVISION

A. All functions of system shall be fully electrically supervised. Upon any system fault or component failure, appropriate audible and visible signals shall be activated to indicate the nature of the trouble.

B. Individual trouble messages shall be provided for each alarm and indicating circuit.

C. Upon application of primary power failure, the system shall automatically be in a normal supervisory condition. Systems which require operator intervention to reset manual controls following a primary power restoration shall not be acceptable.

D. Upon power outage, the system shall signal "AC Failure" and sound an audible trouble signal. The entire system shall be provided with 24 hours of standby power in the supervisory mode and 5 minutes in the alarm mode. Note maximum number of devices system can accommodate in shop drawing submittal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. System components specified herein are those of Notifier and are intended to establish type and quality required. Similar equipment by Edwards System Technologies or Simplex are acceptable.

2.2 SYSTEM COMPONENTS

A. Fire Alarm Control Panel (FACP):
   1. The Fire Alarm Control (FACP) Panel shall be fully solid state and of modular design, for ease of future system extension and/or modification. The front of the panel must have steady Power On indication and each alarm initiation device must have separate Alarm and Trouble indications.
   2. The FACP power supply shall have a continuous rating adequate to power all devices and functions in full alarm continuously. Detection modules and alarm modules must be able to withstand prolonged short circuits in the field wiring, either line to line or line to ground, without damage.
   4. The system must be equipped with the following protective devices to prevent damage or nuisance alarms by nearby lightning strikes, stray currents, or voltage transients:
      a. On AC Input: GE 9L15ECA001, Leviton 51010-WM, or Square D Q02175SB, or equivalent.
   5. The FAC panel must have an Alarm Silence switch with subsequent Alarm (alarm resound) feature.
   6. All common modules, power supplies, amplifiers, control modules, relay and components as necessary to effect the fire alarm, detection, communication and control functions as herein specified and as indicated on the drawings shall be provided as required.
   7. Surface mounted enclosure, with locked door.
   8. System shall be provided with a separate and independent source of emergency power. Switching to emergency power during alarm shall not cause signal drop-out. Any batteries must meet the appropriate NFPA capacity requirements, with a 25% safety factor.
   9. FACP shall be equivalent to the Notifier NFW-100 series.

B. Remote Annunciator:
   1. Remote annunciator shall be LCD type with wide viewing angle to indicate all alarm, trouble and supervisory conditions.

C. Wiring:
   1. Wiring shall be, installed in conduit, tight to structure (tie wrapped at intervals not to exceed 4’-0” on center.
   2. Conductors shall be copper. Conductors shall be #14 AWG solid THWN or XHHW.
   3. All junction boxes shall be accessible. All junction box covers shall be painted red.
   4. Addressable communications fire alarm wiring shall be shielded type as required by the system manufacturer.

D. Manual Stations:
   1. Manual pull stations shall be double action, push/pull type with integral address module, red in color, with “FIRE” or “FIRE ALARM” printed in white letters.
   2. Stations shall be Notifier NOT-BG12LX Type for semi-flush mounting.

E. Detectors:
   1. Detector bases shall be for ceiling mounting and operate from 24 VDC power from control panel. Detectors shall have environmental compensating and adjustable sensitivity, condition indicator to be flashing LED for normal, continuous LED for alarm. Trouble condition shall not interfere with the operation of other detectors in the circuit. Smoke detectors shall be photo-electric type unless otherwise noted.
      a. Photoelectric Smoke Detectors: Detectors shall be provided with insect screens and means to minimize entry of dust and air turbulence. Units shall be Notifier NP-100 for typical use.
      b. Ionization Smoke Detectors: Detectors shall be dual chamber ionization type designed to sense both visible and invisible products of combustion. Unit shall be Notifier NI-100 Type. Ionization detectors shall be used in Electrical Equipment Rooms.
      c. Heat Detectors: Detectors shall be combination rate of rise-fixed temperature type. Rate of rise shall be 15°F per minute with a fixed set-ting of 135°F. Unit shall be Notifier NH-100R Type.

F. Duct Detectors:
   1. Duct Detectors shall be ND-100 Type photoelectric type detectors in duct mount housing with 24 VDC power operated from control panel.
      a. The Electrical Contractor shall verify with the Mechanical Contractor the tube lengths required and supply the complete units to the Mechanical Contractor for installation in the ducts. All wiring shall be by the Electrical Contractor.
      b. HVAC shutdown shall be from the FACP in order to integrate shutdown override at the FACP. Coordinate with the mechanical contractor as required.
      c. Provide remote test switch with reset and indicating light installed in an accessible location near its associated detector, Notifier RTS451KEY.
      d. The connector head components shall be supervised so that their failure shall cause a trouble indication in the Fire Alarm Control Panel.

G. Signaling Devices:
   1. Combination horn and visual strobe light shall be equal to Notifier HS24 series. Synchronization shall be provided for strobe lights in all areas where two or more devices are visible.
   2. Mount combination horn/strobe or strobe only device 80" above finish floor to bottom of strobe lens or 6" below ceiling maximum when ceiling height is less than 7'-0".

3. Mount horn only device aligned with top of door frame.
4. Visual signals shall have side viewing lens, white in color with the words "FIRE" printed on each side.
5. Visual signal shall be 24 VDC Xenon flasher with built-in reflector and shall be in accordance with ADA requirements.
6. Coordinate signaling devices carefully with visual signal to provide a complete integral unit.
7. Units shall be white, where allowed by the local authority having jurisdiction.

H. Hold Open Devices:
1. Hold open devices shall be 24 vdc, Notifier FM series as required. Provide low profile type for wall mounting, floor mounted as required elsewhere.

I. Battery Module:
1. Standby emergency power shall be provided to automatically power the system upon loss of 120 VAC input power.
   a. Battery shall be sealed, maintenance free, lead calcium type.
   b. After restoration of normal power, battery shall be automatically recharged and shall be continually float charged to maintain full power.
   c. Module shall be fused to protect against over-current and accidental reversal of polarity.
   d. Module shall be monitored to indicate low battery, battery disconnected or charge failure.

J. Sprinkler, Flow and Tamper Switches:
1. Provide addressable module for each flow and tamper switch in the sprinkler system. Switches are to be provided by sprinkler contractor, modules and required wiring to be provided by this contractor.

K. Spare Parts:
1. Provide two (2) fuses of each size used in the system.
2. Provide 4 additional glass rods for the fire alarm pull stations.
3. Provide two photoelectric smoke detectors
4. Provide two combination horn/strobe units.
5. Provide four strobe only units.

2.3 VERIFICATION OF SYSTEM PERFORMANCE

A. Upon completion of the installation, and prior to final inspections, the CONTRACTOR AND THE MANUFACTURER'S AUTHORIZED REPRESENTATIVE together shall test every alarm initiating device for proper response and zone indication, every alarm signaling appliance for effectiveness, and all auxiliary functions such as capture of elevators and control of smoke doors/dampers and HVAC systems. This will often require a coordinated effort involving several trades and contractors, since some of the things to be tested may have been furnished and/or installed by someone other than the Electrical Contractor.

B. The Owner and the Engineer will be given the opportunity to witness these tests. An itemized Test Report will be submitted to the Consulting Engineer and the Owner, detailing and certifying all results, including the measured sensitivity of each smoke detector. The data for each smoke detector will include the Manufacturer's serial number, plus specific location information adequate to quickly pinpoint the device.

C. In the event of any system malfunctions or nuisance alarms, the Contractor will take appropriate corrective action. However, this may necessitate a repeat of the response test, if the Owner so desires. Continued improper performance during warranty shall be cause to require the Contractor to remove the system.

D. System Documentation, Training, and Maintenance

1. The contractor shall provide the Engineer with three (3) copies of the following, to be forwarded to the owner:
   a. As-built wiring and conduit layout diagrams, incorporating wire color code and/or label numbers, and showing all inter-connections in the system.
   b. Schematic wiring diagrams of all control panels, modules, communications panels, etc.
   c. Technical literature on all major parts of the system, including detector heads, manual stations, signaling devices, alarm panels, and power supplies.
2. The manufacturer's authorized representative must instruct the Owner's designated employees in proper operation of the system and all required periodic maintenance. This instruction will include two (2) copies of a written, bound summary, for future reference.
3. Basic operating instructions shall be provided at the FACP. Programmed device descriptions shall note location per Owner designations. Contractor shall obtain from the architect a reduced scale drawing (11” x 17” or smaller) in order to note space designations.
4. The contractor must have the manufacturer's authorized representative provide a quotation for regular preventative maintenance, in accordance with the recommendations of NFPA, 72H, "Guide for Testing Protective Signaling Systems." This will cover the first 12 months period after expiration of the standard warranty. This quotation will provide the owner with information on internal versus contract maintenance costs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All fire alarm wiring shall be installed in conduit. Under no circumstances shall any fire alarm detection/initiating circuit be combined in the same conduit run with other building circuits. Within FAC panel, AC control circuits shall be isolated/insulated

away from other circuits and the enclosure shall have an appropriate warning label alerting service personnel of the presence of high voltage.

B. No splicing or "wire-nut" connection of fire alarm wiring is permitted. All required terminations shall be continuous from device terminal to device terminal. If an intermediate termination is required, utilize Square-'D' TC series terminal strips suitable for wiring being used. Only one wire per terminal.

C. No annunciation circuit shall be more than 70% loaded prior to final inspections to allow addition of audible and strobe devices as may be required per local Fire Marshal.

D. All wiring shall be checked for shorts, grounds, and opens prior to termination at cabinets or detector heads. The minimum resistance to ground or between any two conductors shall be ten megohms, verified in writing, with "megger" headings.

E. Electrical contractor shall coordinate with mechanical contractor as required to extend HVAC shut-down interlock wiring to unit controller as required. Final connection at HVAC controller shall be by mechanical contractor/controls contractor.

F. Coordinate with the elevator for elevator recall wiring. Electrical contractor to extend wiring to unit controllers. Final connection to controllers shall be by elevator contractor.

G. Coordinate with the security/access control vendor for mag-lock interlock wiring. Electrical contractor to extend wiring to unit controllers. Final connection to controllers shall be by access control contractor.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Provide earthwork, including clearing and grubbing, excavation, fill, backfill and compaction for building areas and concrete walks and slabs, shown on the drawings and specified as required to complete work.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: Contractor shall employ and pay an independent soil testing and inspection service to perform a soil survey for satisfactory soil materials, sampling and testing for quality control during earthwork operations.

C. Test for Proposed Soil Materials:
   1. Test soil materials proposed for use in the work and promptly submit test result reports.
   2. Provide one optimum moisture-maximum density curve for each type of soil encountered in subgrade and fills under building foundations and slab areas. Determine maximum densities in accordance with ASTM D 1557, and ASTM D 4253, as applicable.
   3. For borrow materials, perform a mechanical analysis, AASHTO-T88 plasticity index, AASHTO T91; moisture-density curve, AASHTO-T180 or ASTM D 1557.

D. Project Geotechnical Report: Perform earthwork in accordance with the recommendations of the geotechnical report for the project.

1.3 SUBMITTALS

A. Test Reports: Submit two copies of the following reports to the Architect-Engineer:
   1. Test report on borrow material.
   2. Field density test reports.
   3. Optimum moisture-maximum density curve for each type of soil encountered.

B. Submit Manufacturer's Literature for vibratory compaction equipment.

1.4 JOB CONDITIONS

A. Protection: Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations. Should any uncharted utilities be found, notify the utility company and Architect-Engineer immediately and await instructions before proceeding further with work in that location.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill and Backfill Materials: Clean, free-draining sand (max. 10% passing the 200 mesh sieve) free from organic materials.

B. Excavated material conforming to requirements for fill and backfill material may be used for fill and backfill.

C. Provide additional fill material from off-site when required to complete the work.

2.2 VIBRATORY COMPACTION EQUIPMENT

A. Vibratory Roller: The vibratory drum roller shall be as recommended in the geotechnical report for the project. Vibratory roller shall not be used within 30 feet of existing structures. Use mechanical hand tampers.

B. Mechanical Hand Tampers: Hand tampers shall be capable of meeting the compaction requirements specified herein.

PART 3 – EXECUTION

3.1 CLEARING AND GRUBBING BUILDING AREAS

A. Clear and grub the entire building area to at least 5 feet beyond perimeter of building footings and foundation, walks and slabs to remove stumps, roots, trees, vegetation, organic material and other obstructions to the work. Grub out all roots larger than ¼ inch in diameter, matted roots and other organic material to at least 24 inches below existing surface.

B. Strip topsoil from areas within the building and slab areas and stockpile on the site for future use in site grading.

3.2 EXCAVATION

A. Surcharge the building pad as recommended by the geotechnical report.

B. Excavate to depths and dimensions required for footings, slabs and structures. Remove and dispose of all obstructions to the work that are encountered above and below grade during excavation operations. Removal and disposal includes the following:
   1. Stumps, roots, trees and other organic materials.
   2. Pavement, foundations, concrete, and other inorganic materials.
   3. Abandoned utilities and utilities indicated to be removed.
   4. Organic and other unsuitable soil materials.

C. Stability of Excavations:
   1. Slope the sides of excavation to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
   2. Shoring and Bracing: Provide shoring and bracing to comply with local codes and authorities having jurisdiction.

D. Dewatering:
   1. Prevent surface water and subsurface or groundwater from flowing into excavations and flooding the project site and surrounding area.
   2. Do not allow water to accumulate in excavations. Provide dewatering system components necessary to convey the water away from excavations.

E. Excavation for Structures:
   1. Conform to the elevations and dimensions shown on the drawings, with a tolerance of plus or minus 0.10 ft., and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
   2. In excavating for footings and foundations, take care not to disturb bottom of the excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to the required lines and grades to leave a solid base to receive concrete.
   3. Where bottom of footing occurs in fill material, the fill and compaction operations shall continue until a minimum grade of 12” above bottom of footing is obtained. Footings may then be placed by excavating in accordance with methods herein specified.
   4. Foundations shall be constructed as soon as possible after the foundation excavation to minimize damage to the bearing surface. If the bearing surface is softened by surface water intrusion or exposure, the softened soils must be removed immediately prior to placement of concrete. The bearing surface may be protected from extended exposure or imminent rainfall by placing a 2” mat of lean concrete on the bearing surface. Increase the foundation depth accordingly.

F. Cold Weather Protection: Protect excavation bottoms against freezing when the atmospheric temperature is less than 35 degrees F.

3.3 COMPACTION REQUIREMENTS

A. General: Compact and fill and backfill to the same density as adjacent in-place material.

B. Compaction Under Slabs and Structures:
   1. All building areas shall be compacted and densified using a vibratory drum roller as specified herein. Vibratory compaction shall extend at least 5 feet beyond perimeter of building footings and foundations, slabs and walks. A minimum of twelve complete coverages, six in each direction, shall be made with the roller. Any soft yielding areas shall be excavated and replaced with acceptable fill material. Fill shall be placed in lifts not exceeding 12 inches in loose thickness (6 inches for mechanical hand tampers). Continue compaction until requirements specified herein are attained.

C. Percentage of Maximum Density Requirements: Compact soils to not less than the following percentages of the Modified Proctor maximum dry density, ASTM D 1557.
   1. Existing Subgrades Under Structures: Compact subgrade 24 inches below existing grade to 95 percent maximum density at optimum moisture.
   2. Fill and Backfill Under Footings and Foundations: Compact each layer of fill or backfill to 95 percent maximum density at optimum moisture.
   3. Walks and Slabs: Compact top 12 inches of subgrade and each layer of fill or backfill to 95 percent maximum density at optimum moisture.

D. Moisture Control:
   1. Where the subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to the surface or subgrade, or layer of soil material, to prevent free water appearing on the surface during subsequent to compaction operations.
   2. Remove and replace, dewater, or scarify and air dry soil material that is too wet to permit compaction to specified density.

E. Backfilling Under Slabs and Structures:
   1. Continue backfilling and compaction over entire building area to final elevation. Backfilling shall be in equal layers compatible with equipment used.

3.4 FIELD TESTING

A. Number of tests:
   1. Make one optimum moisture-maximum density curve test in accordance with ASTM D 1557 for each class of material.
   2. Make in-place density tests in accordance with ASTM D 1556, ASTM D 2937, or ASTM D 4253, as applicable, as fill and backfill work progresses. Test locations shall be as follows:
      a) approximately every 185 cubic yards of fill and backfill, or 5,000-sq. ft. of building area, shall be tested;

b) 1 test per 100 ft^2 of bearing surface for isolated spread footings (at a minimum of every 3rd isolated spread footing);
c) at 50 linear feet of continuous wall footings.

B. Work on Tested Area: Placing permanent construction over fill that has not been tested and approved may require the Contractor to remove permanent work, recompact the fill and replace the work.

C. Test Reports:
1. Two copies of test reports shall be transmitted directly from the laboratory to the Architect-Engineer as directed.
2. Test reports shall be identified by the project title, A.E. File number, project location, and location and depth of each on-site test submitted.

END OF SECTION 31 0000