

Fort Dupont Ice Arena

Washington, DC



BID SET

SPECIFICATIONS – VOLUME 1

15 DECEMBER 2017



SINKCOMBSDETHLEFS
SPORTS ARCHITECTURE



QUINN EVANS
ARCHITECTS

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END OF VOLUME 2

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Work under separate contracts.
5. Future work.
6. Purchase contracts.
7. Owner-furnished products.
8. Contractor-furnished, Owner-installed products.
9. Access to site.
10. Coordination with occupants.
11. Work restrictions.
12. Specification and drawing conventions.
13. Miscellaneous provisions.

- B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: FORT DUPONT ICE ARENA.

1. Project Location: 3779 Ely Place, Washington, DC.

- B. Owner: DISTRICT OF COLUMBIA, DEPARTMENT OF GENERAL SERVICES.

1. Owner's Representative: Brian J. Hanlon, Director, Department of General Services, 2000 14th Street, NW, 8th Floor, Washington, DC 20009.

- C. Architect of Record: Quinn Evans Architects.

1. Address: 2121 Ward Place, NW, 4th Floor, Washington, DC 20037

- D. Design Architect: Sink Combs Dethlefs.
1. Address: 475 Lincoln Street, Suite 100, Denver, CO 80203
- E. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Mechanical and Plumbing Engineers: ME Engineers.
 2. Structural Engineers: ReStl Designers.
 3. Civil Engineers: Delon Hampton and Associates.
 4. Electrical and Life Safety Engineers: JVP Engineers, P.C.
 5. Landscape Architects: Lee and Associates, Inc.
 6. Food Service Consultant: Nyikos Associates, Inc.
 7. Cost Estimator: O'Connor Construction Management.
- F. Other Owner Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. **<Insert title of design discipline>**: **<Insert name and contact information for consultant>**. **<Insert title of design discipline>** has prepared the following portions of the Contract Documents:
 - a. **<Insert description of scope of service for other Owner consultant>**.
- G. Contractor: **<Insert name and contact information for Contractor>** has been engaged as Contractor for this Project.
- H. Construction Manager: **<Insert name and contact information for Construction Manager>**.
1. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and **[each]** Contractor, according to a separate contract between Owner and Construction Manager.
 2. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.
- I. Project Web Site: A project Web site administered by **[Architect]** **[Owner]** **[Construction Manager]** **[Contractor]** will be used for purposes of managing communication and documents during the construction stage.
1. See Section 013100 "Project Management and Coordination." for requirements for **[establishing]** **[administering]** **[and]** using the Project Web site.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
1. The Fort Dupont Ice Arena consists of two ice sheets, one elevated above parking; Multi Purpose Room, Skate Rental; Concessions; Lockers; and Offices for staff. The site is located in Washington, DC at 3779 Ely Place..

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

1.5 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
 - 1. **<Insert a brief description of work performed by Owner>.**
- C. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
 - 1. **<Insert a brief description of work performed by Owner>.**
- D. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
 - 1. **<Insert a brief description of work performed by Owner>.**

1.6 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Preceding Work: Owner **[has awarded]** **[will award]** separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
 - 1. **<Insert name of the Contract>: To <Insert name of separate Contractor> [to] [for] <Insert a brief description of work performed under separate contract>.**
- C. Concurrent Work: Owner **[has awarded]** **[will award]** **[and will assign to Contractor]** separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
 - 1. **<Insert name of the Contract>: To <Insert name of separate Contractor> [to] [for] <Insert a brief description of work performed under separate contract>.**

D. Subsequent Work: Owner [**has awarded**] [**will award**] separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. **<Insert name of the Contract>**: To **<Insert name of separate Contractor>** [**to**] [**for**] **<Insert a brief description of work performed under separate contract>**.

1.7 FUTURE WORK

A. The Contract Documents include requirements that will allow Owner to carry out future work following completion of this Project; provide for the following future work:

1. **<Insert description of future work requiring consideration during construction of the Work of this Contract>**.

1.8 PURCHASE CONTRACTS

A. General: Owner has negotiated purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.

1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

B. Purchase Contracts Information:

1. **<Insert product name>**: See Section **<Insert Section number>** "**<Insert Section title>**."
 - a. Purchase Contract Firm and Representative: **<Insert name and contact information for purchase contract firm and representative>**.
 - b. Purchase Contract Scope: [**Furnishing material**] [**Material and installation labor**] **<Insert description of contract>**.
 - c. Purchase Status: [**Price negotiated by Owner, to be incorporated in the Contract Sum by Contractor; see Section 012100 "Allowances" for cash allowance for purchase contract**] [**Price negotiated and incorporated in the Contract Sum by Contractor**] [**Product reserved by Owner**] [**Order placed and deposit paid by Owner**] [**Order to be placed by Contractor**] **<Insert description of status of purchase contract>**.
 - d. Quantity: **<Insert quantity ordered>**.
 - e. Other Requirements: **<Insert special requirements>**.

1.9 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products[**and making building services connections**].
- B. Owner-Furnished Products:
 - 1. **<Insert description, in separate subparagraphs, for each Owner-furnished product>**.

1.10 CONTRACTOR-FURNISHED, OWNER-INSTALLED PRODUCTS

- A. Contractor shall furnish products indicated. The Work includes unloading, handling, storing, and protecting Contractor-furnished products as directed and turning them over to Owner at Project closeout.
- B. Contractor-Furnished, Owner-Installed Products:
 - 1. **<Insert description, in separate subparagraphs, for each Contractor-furnished, Owner-installed product>**.

1.11 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 **[work in areas] [areas within the Contract limits]** indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to **<Insert description of areas where work is permitted>**.
 - 2. [<Double click to insert sustainable design text for site disturbance.>](#)
 - 3. Driveways, Walkways and Entrances: Keep driveways[**parking garage,**] [**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.

- D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.12 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and [existing] [adjacent] building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than [72] <Insert number> hours in advance of activities that will affect Owner's operations.
- B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than [72] <Insert number> hours' notice to Owner of activities that will affect Owner's operations.
- C. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.13 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 **<Insert time>** a.m. to **<Insert time>** p.m., Monday through Friday, unless otherwise indicated.
1. Weekend Hours: **<Insert restrictions on times permitted for weekend work>**.
 2. Early Morning Hours: **<Insert restrictions or references to regulations by authorities having jurisdiction for restrictions on noisy work>**.
 3. Hours for Utility Shutdowns: **<Insert Owner's restrictions>**.
 4. Hours for **[Core Drilling]** **<Insert noisy activity>**: **<Insert Owner's restrictions>**.
- 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 **[Architect]** **[Construction Manager]** **[Owner]** not less than **[two]** **<Insert number>** days in advance of proposed utility interruptions.
 2. Obtain **[Architect's]** **[Construction Manager's]** **[Owner's]** written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify **[Architect]** **[Construction Manager]** **[Owner]** not less than **[two]** **<Insert number>** days in advance of proposed disruptive operations.
 2. Obtain **[Architect's]** **[Construction Manager's]** **[Owner's]** written permission before proceeding with disruptive operations.
- E. [<Double click to insert sustainable design text for nonsmoking buildings.>](#)
- F. Controlled Substances: Use of tobacco products and other controlled substances **[within the existing building]** **[on Project site]** is not permitted.
- G. Employee Identification: **[Provide]** **[Owner will provide]** identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. 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.

1.14 SPECIFICATION AND DRAWING CONVENTIONS

- A. 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.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. 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 abbreviations [**published as part of the U.S. National CAD Standard**] [**and**] [**scheduled on Drawings**].
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.15 MISCELLANEOUS PROVISIONS

- A. **<Insert miscellaneous provisions>.**

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1 and 2:

1. Base Bid: Air Cooled Scroll Ice Chillers.
2. Alternate 1: Ice chiller plant upgraded to a water-cooled system using commercial-grade R-134a screw machines.
 - a. System can be installed by a reputable local commercial mechanical contractor using “standard” HVAC equipment and components.
 - b. Provides the ability to reclaim heat from the ice chiller plant to use for the ice sheet subfloor heating systems, the snowmelt pit, domestic water pre-heating, and potentially for HVAC heating loads.
 - c. Includes adding cooling tower to the roof over the ice resurfacing area and a remote sump tank in the mechanical room.
 - d. Includes adding a heat reclaim glycol tank and pump skid for recovering waste heat from the ice chiller plant.
 - e. Includes adding refrigeration machinery room elements to the design (such as EPO switch, SCUBA gear, refrigerant exhaust system, etc.
 - f. Requires a larger mechanical room (65’x35’) for the indoor chiller equipment, heat exchangers and tanks.
3. Alternate 2: Ice chiller plant upgraded to a water-cooled system using an ammonia refrigerant reciprocating compressor skid.
 - a. This would be a complete turn-key system by a national ice system contractor/provider, such as CIMCO, and would be engineered, built, installed, started-up and commissioned by the ice system contractor.
 - b. Provides the ability to reclaim heat from the ice chiller plant to use for the ice sheet subfloor heating systems, the snowmelt pit, domestic water pre-heating, and potentially for HVAC heating loads.
 - c. Includes adding an evaporative condenser to the roof over the ice resurfacing area and a remote sump tank in the mechanical room.
 - d. Includes adding an ammonia dilution tank in case of a refrigerant leak.
 - e. Includes adding a heat reclaim glycol tank and pump skid for recovering waste heat from the ice chiller plant.
 - f. Includes adding refrigeration machinery room elements to the design (such as EPO switch, SCUBA gear, refrigerant exhaust system, etc.

- g. Requires a larger mechanical room (65'x35') for the indoor chiller equipment, heat exchangers and tanks.
- B. Alternate No. 3 and 4:
 - 1. Base Bid: Provide battery power for emergency lighting.
 - 2. Alternate 3: 800kW emergency generator for emergency lighting, elevator and ice chiller plant.
 - a. Site work inclusive of pad, enclosure and landscaping at generator location.
 - 3. Alternate 4: 60kW emergency generator for emergency lighting and elevator.
 - a. Site work inclusive of pad, enclosure and landscaping at generator location.
- C. Alternate No. 5:
 - 1. Base Bid: 85' x 185' Elevated Ice Rink.
 - 2. Alternate: Enlarge elevated ice sheet to 85' x 200'.
 - a. Includes additional building structure, skin, glazing and site work.
 - b. Includes increased lengths of duct work, piping and conduit.
 - c. Includes increased number of light fixtures.
 - d. Includes increased seating capacity.
- D. Alternate No. 6:
 - 1. Base Bid: No on site renewable energy.
 - 2. Alternate: Install infrastructure for future installation of solar panels on elevated ice rink roof.
 - a. Includes:
 - 1) Increased structural capacity of roof by 22 psf for panels and ballast;
 - 2) Conduit path from roof to main electrical room;
 - 3) Panel in electrical room for inverter and distribution;
 - 4) Conduit path from panel for distribution to building.
 - 5) Change roof material to EPDM membrane roofing.
 - 6) Additional design fee required to design and document system.
- E. Alternate No. 7:
 - 1. Base Bid: NHL ice sheet detail – 8” cold slab on 4” insulation, 12” compacted sand bed, and 8” gravel bed with drainage pipes below.
 - 2. Alternate: NHL ice sheet detail – 6” cold slab on 4” insulation, 6” compacted sand bed, and 6” structural slab over 8” gravel bed with drainage pipes below.
- F. Alternate No. 8:
 - 1. Base Bid: Lined and painted sheet metal ductwork over ice rinks.
 - 2. Alternate: Ice Rink Fabric Ductwork – replace lined and painted sheet metal ductwork with fabric duct system (KE Fibertec, DuctSox, or equivalent).

END OF SECTION 012300

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project 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. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
 - 2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
 - 5. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 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. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with 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 with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors 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.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 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 Section 013300 "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] [DXF] [DGN], Version <Insert designation>, operating in [Microsoft Windows] [Apple Macintosh] operating system.
 3. File Submittal Format: Submit or post coordination drawing files using [format same as file preparation format] [Portable Data File (PDF) format].
 4. BIM File Incorporation: [Develop and incorporate] [Construction Manager will incorporate Contractor's] coordination drawing files into Building Information Model established for Project.
 - a. [Perform] [Construction Manager will perform] three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 5. Architect will furnish Contractor one set of digital data files of 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 <Insert name and version of digital data software program and operating system>.
 - c. Contractor shall execute a data licensing agreement in the form of [AIA Document C106] [Agreement included in this Project Manual] [Agreement form acceptable to Owner and Architect].

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: 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.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.

3. Date.
 4. Name of Contractor.
 5. Name of Architect and Construction Manager.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.

- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly . Use CSI Log Form 13.2B. or Software log with not less than the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect and Construction Manager.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's and Construction Manager's response was received.
- F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT WEB SITE

- A. [Use Architect's] [Use Owner's] [Use Construction Manager's] **[Provide, administer, and use]** Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:
1. Project directory.
 2. Project correspondence.
 3. Meeting minutes.
 4. Contract modifications forms and logs.
 5. RFI forms and logs.
 6. Task and issue management.
 7. Photo documentation.
 8. Schedule and calendar management.
 9. Submittals forms and logs.
 10. Payment application forms.
 11. Drawing and specification document hosting, viewing, and updating.
 12. Online document collaboration.
 13. Reminder and tracking functions.
 14. Archiving functions.
 15. **<Insert description of software feature>**.
- B. Provide up to [seven] **<Insert number>** Project Web site user licenses for use of the Owner[, **Owner's Commissioning Authority**] [, **Construction Manager**], Architect, and Architect's consultants. Provide [eight] **<Insert number>** hours of software training at Architect's office for Project Web site users.

- C. On completion of Project, provide [one] <Insert number> complete archive copy(ies) of Project Web site files to Owner and to Architect in a digital storage format acceptable to Architect.
- D. Provide [one of]the following Project Web site software packages under their current published licensing agreements:
 - 1. Autodesk, Buzzsaw.
 - 2. Autodesk, Constructware.
 - 3. Meridian Systems, [Prolog] [Prolog and ProjectTalk].
 - 4. <Insert name of hosting company and product>.
- E. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of [AIA Document C106] [Agreement included in this Project Manual] [Agreement acceptable to Owner and Architect].

1.9 PROJECT MEETINGS

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: 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, Construction Manager, and Architect, within three days of the meeting.
- B. Preconstruction Conference: Construction Manager will 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, Owner's Commissioning Authority, , Construction Manager, 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. Sustainable design requirements.
 - m. Preparation of record documents.
 - n. Use of the premises.
 - o. Work restrictions.
 - p. Working hours.
 - q. Owner's occupancy requirements.
 - r. Responsibility for temporary facilities and controls.
 - s. Procedures for moisture and mold control.
 - t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. First aid.
 - z. Security.
 - aa. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Sustainable Design Coordination Conference: Construction Manager will schedule and conduct a sustainable design coordination conference before starting construction, at a time convenient to Owner, Construction Manager, Architect, and Contractor.
- 1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent and sustainable design coordinator; 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.
 - 2. Agenda: Discuss items of significance that could affect meeting sustainable design requirements, including the following:
 - a. Sustainable design Project checklist.
 - b. General requirements for sustainable design-related procurement and documentation.
 - c. Project closeout requirements and sustainable design certification procedures.
 - d. Role of sustainable design coordinator.
 - e. Construction waste management.
 - f. Construction operations and sustainable design requirements and restrictions.
 - 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- D. 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, Construction Manager, and Owner's Commissioning Authority 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. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- E. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.

2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for completing sustainable design documentation.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Coordination of separate contracts.
 - l. Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- F. Progress Meetings: Construction Manager will conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Construction Manager, and Architect, each contractor, subcontractor, 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) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site utilization.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) 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.

- G. Coordination Meetings: Construction Manager will conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 - 1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Construction Manager, and Architect, each contractor, subcontractor, 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 meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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.
- b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for preparing a combined Contractor's construction schedule.
 - 2. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 3. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
 - 3. 3 paper copies.
- B. Startup construction schedule.
 - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at weekly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
1. Review software limitations and content and format for reports.
 2. Verify availability of qualified personnel needed to develop and update schedule.
 3. Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial Owner occupancy.
 4. Review delivery dates for Owner-furnished products.
 5. Review schedule for work of Owner's separate contracts.
 6. Review submittal requirements and procedures.
 7. Review time required for review of submittals and resubmittals.
 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 10. Review and finalize list of construction activities to be included in schedule.
 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion .
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following, but not limited to, long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - a. Hydraulic Elevator.
 - b. Ice Making System Equipment.
 - c. Demineralizer Flood Water System Equipment.
 - d. Aluminum Frame Dasher Board System.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 20 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.

- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
1. Temporary enclosure and space conditioning.
 2. Ice making equipment and ice sheet testing.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
1. Use [**Microsoft Project,**] [**Primavera,**] [**Meridian Prolog,**] [**Scheduling component of Project Web site software specified in Section 013100 "Project Management and Coordination,"**] <Insert name of specific software,> for [**Windows XP**] [**Windows Vista**] <Insert current Windows operating system> [**Macintosh OS X**] operating system.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed .
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.

- c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, sustainable design documentation, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.

9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

- B. Contractor's Construction Schedule Updating: At two week intervals, update schedule to reflect actual construction progress and activities. Issue schedule three days before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 01 3233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.
4. Preconstruction video recordings.
5. Periodic construction video recordings.
6. Web-based construction photographic documentation.

- B. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for unit prices for extra photographs.
2. Section 013300 "Submittal Procedures" for submitting photographic documentation.
3. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
5. Section 024116 "Structure Demolition" for photographic documentation before building demolition operations commence.
6. Section 024119 "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.
7. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 ALLOWANCES

- A. Costs: Photographic documentation services are included under the cash allowance for construction photographic services established in Section 012100 "Allowances."

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For photographer .

- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph . Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files within two days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect and Construction Manager.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.5 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
- B. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic equipment, Web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.6 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

2.2 WEB-BASED PHOTOGRAPHIC DOCUMENTATION

- A. Project Camera: Provide fixed exterior camera installation, mounted to provide unobstructed view of construction site from location approved by Architect.
1. Provide one fixed-location camera(s), with the following characteristics:
 - a. Static view .
 - b. Capable of producing minimum 3.0 megapixel pictures.
 - c. Provide power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.
- B. Wireless Hand-Held Camera: Provide portable camera system capable of producing images complying with requirements in this Section, with wireless transmission to service provider's network enabling a live image stream viewable by multiple parties.
1. Provide battery charger, spare battery pack, base station hub, and base station connections in a number and distribution adequate to enable wireless camera operation throughout Project site.
 2. Provide power supply, active high-speed data connection to service provider's network, and static public IP address at base station hub. Provide power supply, conduit, and data wiring between base station hub and base station connections.
- C. Web-Based Image Access: Password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
1. Provide public viewer open access to most recent project camera image.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. Date and Time: Include date and time in file name for each image.
 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect and Construction Manager.

- D. Preconstruction Photographs: Before commencement of demolition and starting construction of main project, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect and Construction Manager.
1. Flag construction limits before taking construction photographs.
 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Architect or Construction Manager-Directed Construction Photographs: From time to time, Architect or Construction Manager will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- G. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
1. Frequency: Take photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment.
 2. Vantage Points: Following suggestions by Architect, Construction Manager and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 - d. Interior Work, through date of Substantial Completion.
- H. Final Completion Construction Photographs: Take 40 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
1. Do not include date stamp.
- I. Additional Photographs: Architect or Construction Manager may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.

3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

3.2 WEB-BASED CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

- A. Live Streaming Construction Site Images: Provide Web-accessible image of current site image from fixed location camera(s), updated at 1 minute intervals during daytime operation.
- B. Time-Lapse Sequence Construction Site Recordings: Provide video recording from a fixed-location camera to show status of construction and progress.
 1. Frequency: Record one frame of video recording every 5 minutes, from same vantage point each time, to create a time-lapse sequence of construction activities.
 2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.
- C. Maintain cameras and Web-based access in good working order according to Web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

END OF SECTION 013233

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's and Construction Manager's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files 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 of the Contract Drawings for use in preparing Shop Drawings[**and Project record 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 **<Insert name and version of digital drawing software program and operating system>**.
 - c. Contractor shall execute a data licensing agreement in the form of **[AIA Document C106, Digital Data Licensing Agreement] [Agreement**

included in Project Manual] [Agreement form acceptable to Owner and Architect].

- d. <Insert conditions on which digital data drawing files will made available>.
- e. The following digital data files will by furnished for each appropriate discipline:
 - 1) Floor plans.
 - 2) Reflected ceiling plans.
 - 3) <Insert name of digital data file>.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

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

- a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

- 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Construction Manager and Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
- 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
- 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.

D. Paper Submittals: Place a permanent label or title block on each 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 and Construction Manager.
3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. 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., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - j. Number and title of appropriate Specification Section.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Other necessary identification.
4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect and Construction Manager will return without review submittals received from sources other than Contractor.
 - a. Transmittal Form for Paper Submittals: Use AIA Document G810.
 - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect.
 - 6) Name of Construction Manager.
 - 7) Name of Contractor.
 - 8) Name of firm or entity that prepared submittal.
 - 9) Names of subcontractor, manufacturer, and supplier.

- 10) Category and type of submittal.
- 11) Submittal purpose and description.
- 12) Specification Section number and title.
- 13) Specification paragraph number or drawing designation and generic name for each of multiple items.
- 14) Drawing number and detail references, as appropriate.
- 15) Indication of full or partial submittal.
- 16) Transmittal number, numbered consecutively.
- 17) Submittal and transmittal distribution record.
- 18) Remarks.
- 19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.

- F. Options: Identify options requiring selection by Architect.

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

- 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 with approval notation from Architect's and Construction Manager's action stamp.

- I. 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.

- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 1. Post electronic submittals as PDF electronic files directly to **[Project Web site]** **[Architect's FTP site]** specifically established for Project.
 - a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Submit electronic submittals via email as PDF electronic files.

- a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 3. Action Submittals: Submit 5 paper copies of each submittal unless otherwise indicated. Architect, through Construction Manager, will return 4 copies.
 4. Informational Submittals: Submit 3 paper copies of each submittal unless otherwise indicated. Architect and Construction Manager will not return copies.
 5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
 - b. 5 paper copies of Product Data unless otherwise indicated. Architect, through Construction Manager, will return 4 copies.

- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least **8-1/2 by 11 inches (215 by 280 mm)**, but no larger than **30 by 42 inches (750 by 1067 mm)**.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - b. **[Two]** opaque (bond) copies of each submittal. Architect[, **through Construction Manager,**] will return **[one]** **<Insert number>** copy(ies).
 - c. **[Three]** **<Insert number>** opaque copies of each submittal. Architect[**and Construction Manager**] will retain **[two]** **<Insert number>** copies; remainder will be returned.
 4. BIM File Incorporation: **[Develop and incorporate]** **[Construction Manager will incorporate Contractor's]** Shop Drawing files into Building Information Model established for Project.
 - a. Prepare Shop Drawings in the following format: **[Same digital data software program, version, and operating system as the original Drawings]** [**<Insert software name and version>**].
 - b. Refer to Section 013100 "Project Management and Coordination" for requirements for coordination drawings.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. 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.
 5. 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 2 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.
 6. 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 4 sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 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 4 sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.

5. Submit product schedule in the following format:
 - a. PDF electronic file.
 - b. 4 paper copies of product schedule or list unless otherwise indicated. Architect, through Construction Manager, will return two copies.

- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. [<Double click to insert sustainable design text for sustainable design submittals.>](#)
- M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- N. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- O. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- P. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- Q. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- R. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

- S. **Material Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- T. **Product Test Reports:** Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- U. **Research Reports:** Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- V. **Preconstruction Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. **Compatibility Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. **Field Test Reports:** Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. **Design Data:** Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

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

- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: **[Incorporate]** **[Construction Manager will incorporate]** delegated-design drawing and data files into Building Information Model established for Project.
 - 1. Prepare delegated-design drawings in the following format: **[Same digital data software program, version, and operating system as the original Drawings]** [**<Insert software name and version>**].

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "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 AND CONSTRUCTION MANAGER'S ACTION

- A. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
 - 1. .
- B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative 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, Commissioning Authority, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
 - 1. Section 012100 "Allowances" for testing and inspecting allowances.

1.3 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 or Construction Manager.
- C. **Mockups:** Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where

indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. 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.
- E. 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.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. 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).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of 7 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.
- 1.4 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.

1.5 ACTION SUBMITTALS

- A. **Shop Drawings:** For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 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. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. 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.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 15 days of Notice of Award, and not less than 7 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 shall not have other Project responsibilities.
- 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, including tests and inspections indicated to be performed by the Commissioning Authority.
- 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 and approved mockups.
- 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.

1.8 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.
- 1.9 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 jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of 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.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, through Construction Manager, 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.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
 2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
 - a. Allow 10 days for initial review and each re-review of each mockup.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings . Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
- M. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups of the following rooms:
- N. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.10 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 Section 013300 "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, Commissioning Authority, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority, Construction Manager, 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.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency with special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect, Commissioning Authority, , Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

- A. **<Insert list of firms acceptable to perform designated tests and inspections>.**

3.2 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, Commissioning Authority's, and Construction Manager's reference during normal working hours.

3.3 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 Section 017300 "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 014000

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 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": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- 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 indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 - 8. ACI - American Concrete Institute; (Formerly: ACI International); www.abma.com.
 - 9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 11. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 12. AGA - American Gas Association; www.aga.org.
 - 13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 15. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 16. AIA - American Institute of Architects (The); www.aia.org.
 - 17. AISC - American Institute of Steel Construction; www.aisc.org.
 - 18. AISI - American Iron and Steel Institute; www.steel.org.
 - 19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 - 20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 - 21. ANSI - American National Standards Institute; www.ansi.org.
 - 22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 - 23. APA - APA - The Engineered Wood Association; www.apawood.org.
 - 24. APA - Architectural Precast Association; www.archprecast.org.
 - 25. API - American Petroleum Institute; www.api.org.
 - 26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).

27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.

70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; (See ECIA).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; www.eciaonline.org.
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
83. FM Approvals - FM Approvals LLC; www.fmglobal.com.
84. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
86. FSA - Fluid Sealing Association; www.fluidsealing.com.
87. FSC - Forest Stewardship Council U.S.; www.fscus.org.
88. GA - Gypsum Association; www.gypsum.org.
89. GANA - Glass Association of North America; www.glasswebsite.com.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
93. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
94. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
95. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
96. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
97. IAS - International Accreditation Service; www.iasonline.org.
98. IAS - International Approval Services; (See CSA).
99. ICBO - International Conference of Building Officials; (See ICC).
100. ICC - International Code Council; www.iccsafe.org.
101. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
102. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
103. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
104. IEC - International Electrotechnical Commission; www.iec.ch.
105. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
106. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
107. IESNA - Illuminating Engineering Society of North America; (See IES).
108. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
109. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
110. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
111. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
112. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.

113. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
114. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
115. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
116. ISO - International Organization for Standardization; www.iso.org.
117. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
118. ITU - International Telecommunication Union; www.itu.int/home.
119. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
120. LMA - Laminating Materials Association; (See CPA).
121. LPI - Lightning Protection Institute; www.lightning.org.
122. MBMA - Metal Building Manufacturers Association; www.mbma.com.
123. MCA - Metal Construction Association; www.metalconstruction.org.
124. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
125. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
126. MHIA - Material Handling Industry of America; www.mhia.org.
127. MIA - Marble Institute of America; www.marble-institute.com.
128. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
129. MPI - Master Painters Institute; www.paintinfo.com.
130. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
131. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
132. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
133. NADCA - National Air Duct Cleaners Association; www.nadca.com.
134. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
135. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
136. NBI - New Buildings Institute; www.newbuildings.org.
137. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
138. NCMA - National Concrete Masonry Association; www.ncma.org.
139. NEBB - National Environmental Balancing Bureau; www.nebb.org.
140. NECA - National Electrical Contractors Association; www.necanet.org.
141. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
142. NEMA - National Electrical Manufacturers Association; www.nema.org.
143. NETA - InterNational Electrical Testing Association; www.netaworld.org.
144. NFHS - National Federation of State High School Associations; www.nfhs.org.
145. NFPA - National Fire Protection Association; www.nfpa.org.
146. NFPA - NFPA International; (See NFPA).
147. NFRC - National Fenestration Rating Council; www.nfrc.org.
148. NHLA - National Hardwood Lumber Association; www.nhla.com.
149. NLGA - National Lumber Grades Authority; www.nlga.org.
150. NOFMA - National Oak Flooring Manufacturers Association; (See NWFMA).
151. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
152. NRCA - National Roofing Contractors Association; www.nrca.net.
153. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
154. NSF - NSF International; www.nsf.org.
155. NSPE - National Society of Professional Engineers; www.nspe.org.
156. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
157. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.

158. NWFA - National Wood Flooring Association; www.nwfa.org.
159. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
160. PDI - Plumbing & Drainage Institute; www.pdionline.org.
161. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
162. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
163. RFCI - Resilient Floor Covering Institute; www.rfci.com.
164. RIS - Redwood Inspection Service; www.redwoodinspection.com.
165. SAE - SAE International; www.sae.org.
166. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
167. SDI - Steel Deck Institute; www.sdi.org.
168. SDI - Steel Door Institute; www.steeldoor.org.
169. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
170. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
171. SIA - Security Industry Association; www.siaonline.org.
172. SJI - Steel Joist Institute; www.steeljoist.org.
173. SMA - Screen Manufacturers Association; www.smainfo.org.
174. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
175. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
176. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
177. SPIB - Southern Pine Inspection Bureau; www.spib.org.
178. SPRI - Single Ply Roofing Industry; www.spri.org.
179. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
180. SSINA - Specialty Steel Industry of North America; www.ssina.com.
181. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
182. STI - Steel Tank Institute; www.steeltank.com.
183. SWI - Steel Window Institute; www.steelwindows.com.
184. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
185. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
186. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
187. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
188. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
189. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
190. TMS - The Masonry Society; www.masonrysociety.org.
191. TPI - Truss Plate Institute; www.tpinst.org.
192. TPI - Turfgrass Producers International; www.turfgrasssod.org.
193. TRI - Tile Roofing Institute; www.tilerroofing.org.
194. UL - Underwriters Laboratories Inc.; www.ul.com.
195. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
196. USAV - USA Volleyball; www.usavolleyball.org.
197. USGBC - U.S. Green Building Council; www.usgbc.org.
198. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
199. WASTEC - Waste Equipment Technology Association; www.wastec.org.
200. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
201. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.

202. WDMA - Window & Door Manufacturers Association; www.wdma.com.
203. WI - Woodwork Institute; www.wicnet.org.
204. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
205. WWPA - Western Wood Products Association; www.wwpa.org.

C. 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. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. 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. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to DDOT UFA standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work, as per DDOT's UFA requirements.
- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1.4 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by ISA
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

1.5 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil
- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
1. Type: Shredded hardwood
- C. Protection-Zone Fencing:
1. Chain-Link Protection-Zone Fencing: galvanized-steel
 - a. Height: 6 feet
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain[or to be relocated]. [Flag] each tree trunk
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
1. Apply 4-inch > average thickness of organic mulch.

3.2 TREE- AND PLANT-PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones [before materials or equipment are brought on the site and construction operations begin] <Insert requirement> in a manner that will prevent people[and animals] from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations
- C. Maintain protection zones free of weeds and trash.
- D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
- E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

3.3 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- C. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.4 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as shown on Drawings
- B. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.5 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches [as recommended by a certified arborist for site safety.

- B. Chip removed branches and dispose of off-site.

3.6 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- C. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.7 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
- B. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative 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. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012300 "Alternates" for products selected under an alternate.
 - 3. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 4. Section 014200 "References" for applicable industry standards for products specified.

1.3 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 (General): 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.

- C. Basis-of-Design Product Specific Source: A specification in which a specific manufacturer's product is named, including make or model number or other designation, to establish the architect's required qualities and design for that specific product related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics. Substitution of Specific Source products may be considered only if the product substitution matches exactly the architect's requirements for qualities and design.
- D. Basis-of-Design Product Sole Source: Product and manufacturer specified shall not be substituted.

1.4 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 through Construction Manager 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 Section 01 3300 "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 Section 01 3300 "Submittal Procedures." Show compliance with requirements.

1.5 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.

1.6 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.

1.7 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 other Sections for specific content requirements and particular requirements for submitting special warranties.

- C. Submittal Time: Comply with requirements in Section 017700 "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. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. 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.
 - 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.
- 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 (General): 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.
 6. Basis-of-Design Product Specific Source: A specification in which a specific manufacturer's product is named, including make or model number or other designation, to establish the architect's required qualities and design for that specific product related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics. Substitution of Specific Source products may be considered only if the product substitution matches exactly the architect's requirements for qualities and design.
 7. Basis-of-Design Product Sole Source: Product and manufacturer specified shall not be substituted.
- 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 Section 012500 "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 016000

SECTION 01 7300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes 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.

- B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "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. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor and professional engineer.

- B. Certificates: Submit certificate signed by land surveyor and professional engineer 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. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- E. Certified Surveys: Submit two copies signed by professional engineer.
- F. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 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, but is not limited to, 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. Conveying systems.
 - j. Electrical wiring systems.
 - k. 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. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. 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.
- 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

- 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 local utility and 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 Section 013100 "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 and Construction Manager 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 and Construction Manager 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 and Construction Manager.

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 or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager 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 three 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 and professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by professional engineer, 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 Section 011000 "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 prevent 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 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 Section 015000 "Temporary Facilities and Controls." and Section 017419 "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

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "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 Section 014000 "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 017300

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
 - 2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 3. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 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.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in **tons (tonnes)**.
 - 4. Quantity of waste salvaged, both estimated and actual in **tons (tonnes)**.
 - 5. Quantity of waste recycled, both estimated and actual in **tons (tonnes)**.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in **tons (tonnes)**.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. [<Double click to insert sustainable design text for construction waste management submittal.>](#)
- H. Qualification Data: For waste management coordinator and refrigerant recovery technician.

- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.
 1. [<Double click to insert sustainable design text for LEED coordinator.>](#)
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 1. Review and discuss waste management plan including responsibilities of waste management coordinator.
 2. Review requirements for documenting quantities of each type of waste and its disposition.
 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in hauling and tipping fees by donating materials.
 7. Savings in hauling and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

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."

- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by **12 inches (300 mm)** or more.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

- D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- E. Plumbing Fixtures: Separate by type and size.
- F. Lighting Fixtures: Separate lamps by type and protect from breakage.
- G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:
 - 1. **<Insert names and telephone numbers of local recycling receivers and processors of recyclable materials>.**
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
- D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- E. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum **1-1/2-inch (38-mm)** size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 1. Pulverize concrete to maximum 1-1/2-inch (38-mm) size.
 2. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 1. Pulverize masonry to maximum 1-inch (25-mm) size.
 - a. Crush masonry and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.
 - b. Crush masonry and screen to comply with requirements in Section 329300 "Plants" for use as mineral mulch.
 2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
 1. Structural Steel: Stack members according to size, type of member, and length.
 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- K. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- N. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

- #### A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, 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. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-5 cost/revenue analysis of construction waste reduction work plan.
- F. Form CWM-6 cost/revenue analysis of demolition waste reduction work plan.
- G. Form CWM-7 for construction waste
- H. Form CWM-8 for demolition waste.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative 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. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 017300 "Execution" for progress cleaning of Project site.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 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.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 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 20 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.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
5. Submit test/adjust/balance records.
6. Submit sustainable design submittals not previously submitted.
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 20 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 Section 017900 "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 20 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager 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.

1.7 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 Section 012900 "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 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager 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.

1.8 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 and proceeding from lowest floor to highest floor.
 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 and Construction Manager.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect, through Construction Manager, will return annotated file.
 - b. PDF electronic file. Architect, through Construction Manager, will return annotated file.
 - c. 6 paper copies. Architect, through Construction Manager, will return 5 copies.

1.9 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 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.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures 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 Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." and Section 017419 "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 017700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative 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. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 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.

1.4 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 and Commissioning Authority 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.
 2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect, through Construction Manager, will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority 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 and Commissioning Authority will return copy with comments.
1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority'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.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

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.
- 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.

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 Section 017839 "Project Record Documents."

- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative 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. Section 011200 "Multiple Contract Summary" for coordinating project record documents covering the Work of multiple contracts.
 2. Section 017300 "Execution" for final property survey.
 3. Section 017700 "Closeout Procedures" for general closeout procedures.
 4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
1. Number of Copies: Submit one set(s) of marked-up record prints.
 2. 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) Submit record digital data files and [one] <Insert number> set(s) of plots.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.

- c. Final Submittal:
 - 1) Submit record digital data files and three set(s) of record digital data file plots.
 - 2) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and 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 miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly 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. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: **[DWG] [DXF] [DGN]**, Version **<Insert designation>**, **[Microsoft Windows] [Apple Macintosh]** operating system.
 3. Format: Annotated PDF electronic file with comment function enabled.
 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 5. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 6. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect and Construction Manager for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other

construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

- D. 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. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.
 - 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 scanned PDF electronic file(s) of marked-up paper copy of Specifications.

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 scanned PDF electronic file(s) of marked-up paper copy of Product Data.

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 and Construction Manager's reference during normal working hours.

END OF SECTION 017839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative 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. Allowances: Furnish demonstration and training instruction time under the Demonstration and Training Allowance as specified in Section 012100 "Allowances."
- C. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up. See requirements in Section 012200 "Unit Prices."

1.3 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 facilitator, instructor, and videographer.
- 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.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit 4 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 and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
 3. 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.
 4. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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.

1.6 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 Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. 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.
- D. 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.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. 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. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

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

END OF SECTION 017900

SECTION 01 8113.13 - SUSTAINABLE DESIGN REQUIREMENTS - LEED 2009 FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Gold certification based on USGBC's "LEED 2009 for New Construction & Major Renovations."
 - 1. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 - 2. A copy of LEED Project checklist is attached at the end of this Section for information only.
 - a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.

1.3 DEFINITIONS

- A. LEED: USGBC's "LEED 2009 for New Construction & Major Renovations."
 - 1. Definitions that are a part of "LEED 2009 for New Construction and Major Renovations" apply to this Section.
- B. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- C. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

- D. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
1. "Postconsumer" material is waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 2. "Preconsumer" material is material diverted from the waste stream during the manufacturing process. Reutilization of materials (such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it) is excluded.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site . Review LEED requirements and action plans for complying with requirements.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from Architect and USGBC about LEED prerequisites and credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until USGBC has made its determination on Project's LEED certification application. Document responses as informational submittals.
- B. Submit documentation to USGBC and respond to questions and requests from USGBC about LEED prerequisites and credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until USGBC has made its determination on Project's LEED certification application.
1. Document correspondence with USGBC as informational submittals.

1.6 ACTION SUBMITTALS

- A. General: Submit additional sustainable design submittals required by other Specification Sections.
- B. Sustainable design submittals are in addition to other submittals.
1. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated LEED requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."
- C. Sustainable Design Documentation Submittals:
1. Credit EA 5: Product Data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time.

2. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
3. Credit MR 4: Product Data for recycled content indicating postconsumer and preconsumer recycled content and cost.
4. Credit MR 5: Product Data for regional materials indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
5. Credit MR 7: Product Data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
6. Credit IEQ 3.1:
 - a. Construction indoor-air-quality management plan.
 - b. Product Data for temporary filtration media.
 - c. Product Data for filtration media used during occupancy.
 - d. Construction Documentation: Six photographs at each of three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
7. Credit IEQ 3.2:
 - a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - b. Product Data for filtration media used during flush-out and during occupancy.
 - c. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
8. Credit IEQ 4.1: Product Data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
9. Credit IEQ 4.2: Product Data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
10. Credit IEQ 4.4: Product Data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.
- B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
 1. Furniture.
 2. Plumbing.
 3. Mechanical.
 4. Electrical.

5. Specialty items such as elevators and equipment.
 6. Wood-based construction materials.
- C. Sustainable Design Action Plans: Provide preliminary submittals within 14 days of date established for the Notice to Proceed indicating how the following requirements will be met:
1. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 2. Credit MR 4: List of proposed materials with recycled content. Indicate cost, postconsumer recycled content, and preconsumer recycled content for each product having recycled content.
 3. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 4. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 5. Credit IEQ 3.1: Construction indoor-air-quality management plan.
- D. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans.

1.8 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to these LEED credits, Contractor shall provide additional materials and procedures necessary to obtain LEED credits indicated.

2.2 RECYCLED CONTENT OF MATERIALS

- A. Credit MR 4: Building materials shall have recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content for Project constitutes a minimum of 20 percent of cost of materials used for Project.
1. Cost of postconsumer recycled content plus one-half of preconsumer recycled content of an item shall be determined by dividing weight of postconsumer recycled content plus one-half of preconsumer recycled content in the item by total weight of the item and multiplying by cost of the item.
 2. Do not include furniture, plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

2.3 REGIONAL MATERIALS

- A. Credit MR 5: Not less than 20 percent of building materials (by cost) shall be regional materials.

2.4 CERTIFIED WOOD

- A. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Heavy timber construction.
 - d. Wood decking.
 - e. Metal-plate-connected wood trusses.
 - f. Structural glued-laminated timber.
 - g. Finish carpentry.
 - h. Architectural woodwork.
 - i. Wood paneling.
 - j. Wood veneer wall covering.
 - k. Wood flooring.
 - l. Wood lockers.
 - m. Wood cabinets.
 - n. Furniture.

2.5 LOW-EMITTING MATERIALS

- A. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Wood Glues: 30 g/L.
2. Metal-to-Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.

14. Fiberglass Adhesives: 80 g/L.
 15. Contact Adhesive: 80 g/L.
 16. Structural Glazing Adhesives: 100 g/L.
 17. Wood Flooring Adhesive: 100 g/L.
 18. Structural Wood Member Adhesive: 140 g/L.
 19. Single-Ply Roof Membrane Adhesive: 250 g/L.
 20. Special-Purpose Contact Adhesive (Contact Adhesive That Is Used to Bond Melamine-Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
 21. Top and Trim Adhesive: 250 g/L.
 22. Plastic Cement Welding Compounds: 250 g/L.
 23. ABS Welding Compounds: 325 g/L.
 24. CPVC Welding Compounds: 490 g/L.
 25. PVC Welding Compounds: 510 g/L.
 26. Adhesive Primer for Plastic: 550 g/L.
 27. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
 28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
 29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
 30. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 31. Other Adhesives: 250 g/L.
 32. Architectural Sealants: 250 g/L.
 33. Nonmembrane Roof Sealants: 300 g/L.
 34. Single-Ply Roof Membrane Sealants: 450 g/L.
 35. Other Sealants: 420 g/L.
 36. Sealant Primers for Nonporous Substrates: 250 g/L.
 37. Sealant Primers for Porous Substrates: 775 g/L.
 38. Modified Bituminous Sealant Primers: 500 g/L.
 39. Other Sealant Primers: 750 g/L.
- B. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: VOC not more than 50 g/L.
 2. Nonflat Paints and Coatings: VOC not more than 150 g/L.
 3. Dry-Fog Coatings: VOC not more than 400 g/L.
 4. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
 7. Pretreatment Wash Primers: VOC not more than 420 g/L.
 8. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 9. Clear Wood Finishes, Lacquers: VOC not more than 550 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. Stains: VOC not more than 250 g/L.
- C. Credit IEQ 4.4: Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

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

3.2 REFRIGERANT AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENT REMOVAL

- A. Prerequisite EA 3: Remove CFC-based refrigerants according to Section 024119 "Selective Demolition" from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in HVAC Sections.
- B. Credit EA 4: Remove clean-agent fire-extinguishing agents that contain HCFCs or halons according to Section 024119 "Selective Demolition" and replace with agent that does not contain HCFCs or halons. See Section 212200 "Clean-Agent Fire-Extinguishing Systems" for additional requirements.

3.3 MEASUREMENT AND VERIFICATION

- A. Credit EA 5: Implement measurement and verification plan consistent with [**Option B: Energy Conservation Measure Isolation**] [**Option D: Calibrated Simulation, Savings Estimation Method 2**] in the EVO's International Performance Measurement and Verification Protocol (IPMVP), "Volume III: Concepts and Options for Determining Energy Savings in New Construction," and as further defined by the following:
 - 1. **<Insert measurement and verification plan design team submitted for credit>.**

3.4 CONSTRUCTION WASTE MANAGEMENT

- A. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."

3.5 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. Credit IEQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
 - 1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 015000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 - 2. Replace air filters immediately prior to occupancy.

3.6 INDOOR-AIR-QUALITY ASSESSMENT

A. Flush-Out:

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of **14,000 cu. ft. (4 300 000 L)** of outdoor air per **sq. ft. (sq. m)** of floor area while maintaining an internal temperature of at least **60 deg F (16 deg C)** and a relative humidity no higher than 60 percent.
 - a. **<Insert operating requirements>**.
2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of **3500 cu. ft. (1 070 000 L)** of outdoor air per **sq. ft. (sq. m)** of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of **0.30 cfm per sq. ft. (1.52 L/s per sq. m)** of outside air or the design minimum outside air rate determined in Prerequisite IEQ 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of **14,000 cu. ft./sq. ft. (4 300 000 L/sq. m)** of outside air has been delivered to the space.
 - a. **<Insert operating requirements>**.

B. Air-Quality Testing: Engage testing agency to perform the following:

1. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in USGBC's "Green Building Design and Construction Reference Guide."
2. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - a. Formaldehyde: 27 ppb.
 - b. Particulates (PM10): 50 mcg/cu. m.
 - c. Total Volatile Organic Compounds (TVOC): 500 mcg/cu. m.
 - d. 4-Phenylcyclohexene (4-PH): 6.5 mcg/cu. m.
 - e. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
3. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
4. Air-sample testing shall be conducted as follows:
 - a. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside airflow rate for the occupied mode throughout the duration of the air testing.

- b. Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
- c. Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. (2300 sq. m) or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
- d. Air samples shall be collected between 3 and 6 feet (0.9 and 1.8 m) from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION 018113.13

SECTION 01 9113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Owner's Project Requirements and Basis-of-Design documentation are included by reference for information only.

1.2 SUMMARY

A. Section Includes:

- 1. General requirements for coordinating and scheduling commissioning.
- 2. Commissioning meetings.
- 3. Commissioning reports.
- 4. Use of test equipment, instrumentation, and tools for commissioning.
- 5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
- 6. Commissioning tests and commissioning test demonstration.
- 7. Adjusting, verifying, and documenting identified systems and assemblies.

B. Related Requirements:

- 1. Section 013300 "Submittal Procedures" for submittal procedures requirements for commissioning.
- 2. Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.
- 3. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal.
- 4. Section 019119.43 "Exterior Enclosure Commissioning" for technical commissioning requirements for exterior closure.
- 5. Section 110800 "Commissioning of Equipment" for technical commissioning requirements for building equipment.
- 6. Section 130800 "Commissioning of Special Construction" for technical commissioning requirements for special construction.
- 7. Section 140800 "Commissioning of Conveying Equipment" for technical commissioning requirements for conveying equipment.
- 8. Section 210800 "Commissioning of Fire Suppression" for technical commissioning requirements for fire suppression.
- 9. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
- 10. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.

11. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.
12. Section 270800 "Commissioning of Communications" for technical commissioning requirements for communications systems.
13. Section 280800 "Commissioning of Electronic Safety and Security" for technical commissioning requirements for electronic safety and security systems.

1.3 ALLOWANCES

- A. Labor and management costs for the performance of commissioning.
- B. The following are excluded from the commissioning allowance:
 1. Equipment and systems installation, startup, and field quality-control testing indicated in the Contract Documents.
 2. Test equipment, instrumentation, and tools (including, but not limited to, proprietary test equipment, instrumentation, and tools) required to perform tests.
 3. Work to correct commissioning issues.
 4. Work to repeat tests when equipment and systems fail acceptance criteria.
 5. **<Insert requirements>**.

1.4 UNIT PRICES

- A. Commissioning allowance may be adjusted up or down by the "List of Unit Prices" Article in Section 012200 "Unit Prices" when actual labor hours are computed at the end of commissioning. See Section 012100 "Allowances" for commissioning allowance.
- B. The following are excluded from the computation for the adjustment of the commissioning allowance for technician labor hours:
 1. Work to correct commissioning issues.
 2. Work to repeat tests when equipment and systems fail acceptance criteria.

1.5 DEFINITIONS

- A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.
- B. Basis-of-Design Document: A document prepared by Owner, Architect, or Commissioning Authority that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.
- C. Commissioning Authority: An entity engaged by Owner, and identified in Section 011000 "Summary," to evaluate Commissioning-Process Work.

- D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.
 - E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of commissioning is defined in Section 011000 "Summary."
 - F. Construction Phase Commissioning Completion: The stage of completion and acceptance of commissioning when resolution of deficient conditions and issues discovered during commissioning and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date Construction Phase Commissioning Completion is achieved. See Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.
 - 1. Commissioning is complete when the work specified in this Section and related Sections has been completed and accepted, including, but not limited to, the following:
 - a. Completion of tests and acceptance of test results.
 - b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
 - c. Comply with requirements in Section 017900 "Demonstration and Training."
 - d. Completion and acceptance of submittals and reports.
 - G. Owner's Project Requirements: A document written by Owner, Architect, or Commissioning Authority that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
 - H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.
 - I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.
 - J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.
 - K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.
- 1.6 COMPENSATION
- A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.
 - 1. Failure to provide timely notice of commissioning activities schedule changes.

2. Failure to meet acceptance criteria for test demonstrations.

B. Contractor shall compensate Owner for such additional services and expenses at the rate of **[\$150.00]** <Insert billing rate> per labor hour plus **[\$500.00]** <Insert rate> per round trip for personnel travelling more than **[200]** <Insert distance> miles plus per diem allowances for meals and lodging according to current U.S. General Services Administration (GSA) Per Diem Rates.

1.7 COMMISSIONING TEAM

A. Members Appointed by Contractor(s):

1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning.
2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning.
3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning.
4. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by Owner:

1. Commissioning authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning.
2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning.
3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

1.8 INFORMATIONAL SUBMITTALS

A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedures general requirements for commissioning.

B. Commissioning Plan Information:

1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors to the performance of the various commissioning requirements.
2. Schedule of commissioning activities, integrated with the construction schedule. Comply with requirements in Section 013200 "Construction Progress Documentation" for construction schedule general requirements for commissioning.
3. Contractor personnel and subcontractors to participate in each test.
4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule.

- D. Two-week look-ahead schedules.
- E. Commissioning Coordinator Letter of Authority:
 - 1. Within 10 days after approval of Commissioning Coordinator qualifications, submit a letter of authority for Commissioning Coordinator, signed by a principal of Contractor's firm. Letter shall authorize Commissioning Coordinator to do the following:
 - a. Make inspections required for commissioning.
 - b. Coordinate, schedule, and manage commissioning of Contractor, subcontractors, and suppliers.
 - c. Obtain documentation required for commissioning from Contractor, subcontractors, and suppliers.
 - d. Report issues, delayed resolution of issues, schedule conflicts, and lack of cooperation or expertise on the part of members of the commissioning team.
- F. Commissioning Coordinator Qualification Data: For entity coordinating Contractor's commissioning activities to demonstrate their capabilities and experience.
 - 1. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of seven 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.
- G. List test instrumentation, equipment, and monitoring devices. Include the following information:
 - 1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
 - 2. Brief description of intended use.
 - 3. Calibration record showing the following:
 - a. Calibration agency, including name and contact information.
 - b. Last date of calibration.
 - c. Range of values for which calibration is valid.
 - d. Certification of accuracy.
 - e. N.I.S.T. traceability certification for calibration equipment.
 - f. Due date of the next calibration.
- H. Test Reports:
 - 1. Pre-Startup Report: Prior to start up of equipment or a system, submit signed, completed construction checklists.
 - 2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
 - 3. Commissioning Issues Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
 - 4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.

5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit print-out of log of alarms that occurred since the last log was printed.

I. Construction Checklists:

1. Material checks.
2. Installation checks.
3. Startup procedures, where required.

1.9 CLOSEOUT SUBMITTALS

A. Commissioning Report:

1. At Construction Phase Commissioning Completion, include the following:
 - a. Pre-startup reports.
 - b. Approved test procedures
 - c. Test data forms, completed and signed.
 - d. Progress reports.
 - e. Commissioning issues report log.
 - f. Commissioning issues reports showing resolution of issues.
 - g. Correspondence or other documents related to resolution of issues.
 - h. Other reports required by commissioning.
 - i. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction Phase Commissioning Completion.
 - j. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction Phase Commissioning Completion.

C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.10 QUALITY ASSURANCE

A. Commissioning Coordinator Qualifications:

1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least seven projects of similar scope and complexity.
2. Certification of commissioning process expertise. The following certifications are acceptable. Owner reserves the right to accept or reject certifications as evidence of qualification.
 - a. Certified Commissioning Professional, by Building Commissioning Association.
 - b. Commissioning Process Management Professional, by American Society of Heating, Refrigerating and Air-Conditioning Engineers.
 - c. Accredited Commissioning Process Authority Professional, by University of Wisconsin.
 - d. Accredited Commissioning Process Manager, by University of Wisconsin.

- e. Accredited Green Commissioning Process Provider, by University of Wisconsin.
- B. Calibration Agency Qualifications: Certified by The American Association of Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

1.11 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

- A. Commissioning Authority Responsibilities: Comply with requirements in Section 011000 "Summary."

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Test equipment and instrumentation required to perform the commissioning shall remain the property of Contractor unless otherwise indicated.
- B. Test equipment and instrumentation required to perform commissioning shall comply with the following criteria:
 - 1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
 - 2. Calibrated and certified.
 - a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but not less than within six months of initial use on Project. Calibration tags permanently affixed.
 - b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.
 - 3. Maintain test equipment and instrumentation.
 - 4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate or perform work on its equipment.

1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.
2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

2.3 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:

1. Bind report in three-ring binders.
2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
3. Record report on compact disk.
4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:
 - a. Test specification.
 - b. Pre-startup reports.
 - c. Approved test procedures.
 - d. Test data forms, completed and signed.
 - e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Review preliminary construction checklists and preliminary test procedures and data forms.

3.2 CONSTRUCTION CHECKLISTS

- A. Construction checklists cannot modify or conflict with the Contract Documents.
- B. Create construction checklists based on actual systems and equipment to be included in Project.

- C. **Material Checks:** Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment, if applicable.
1. Services connection requirements, including configuration, size, location, and other pertinent characteristics.
 2. Included optional features.
 3. **Delivery Receipt Check:** Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness and lack of damage.
 4. **Installation Checks:**
 - a. Location according to Drawings and approved Shop Drawings.
 - b. Configuration.
 - c. Compliance with manufacturers' written installation instructions.
 - d. Attachment to structure.
 - e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
 - f. Utility connections are of the correct characteristics, as applicable.
 - g. Correct labeling and identification.
 - h. **Startup Checks:** Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.
- D. **Startup:** Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, minimum.
- E. **Performance Tests:**
1. **Static Tests:** As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
 2. **Component Performance Tests:** Tests evaluate the performance of an input or output of components under a full range of operating conditions.
 3. **Equipment and Assembly Performance Tests:** Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
 4. **System Performance Tests:** Test and evaluate performance of systems under a full range of operating conditions and loads.
 5. **Intersystem Performance Tests:** Test and evaluate the interface of different systems under a full range of operating conditions and loads.
- F. **Deferred Construction Checklists:** Obtain Owner approval of proposed deferral of construction checklists, including proposed schedule of completion of each deferred construction checklist, before submitting request for Certificate of Construction Phase Commissioning Completion. When approved, deferred construction checklists may be completed after date of Construction Phase Commissioning Completion. Include the following in request for Certificate of Construction Phase Commissioning Completion:

1. Identify deferred construction checklists by number and title.
 2. Provide a target schedule for completion of deferred construction checklists.
 3. Written approval of proposed deferred construction checklists, including approved schedule of completion of each deferred construction checklist.
- G. Delayed Construction Checklists: Obtain Owner approval of proposed delayed construction checklists, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction Phase Commissioning Completion. When approved, delayed construction checklists may be completed after date of Construction Phase Commissioning Completion. Include the following in request for Certificate of Construction Phase Commissioning Completion:
1. Identify delayed construction checklist by construction checklist number and title.
 2. Provide a target schedule for completion of delayed construction checklists.
 3. Written approval of proposed delayed construction checklists, including approved schedule of completion of each delayed construction checklist.

3.3 GENERAL EXECUTION REQUIREMENTS

- A. Schedule and coordinate commissioning with the construction schedule.
- B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.
- C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.
 1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.
 - a. General Inspection: [Level I] [Level II] [Level III] <Insert level>.
 - b. Special Inspection: [Level S-1] [Level S-2] [Level S-3] [Level S-4] <Insert level>.
 - c. Acceptance Quality Limit (AQL) of [1.5] <Insert AQL>.
 2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
 3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
 4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.
- D. Report test data and commissioning issue resolutions.
- E. Schedule personnel to participate in and perform Commissioning-Process Work.
- F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.
2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.4 COMMISSIONING COORDINATOR RESPONSIBILITIES

- A. Management and Coordination: Manage, schedule, and coordinate commissioning, including, but not limited to, the following:
1. Coordinate with subcontractors on their commissioning responsibilities and activities.
 2. Obtain, assemble, and submit commissioning documentation.
 3. **[Attend]** **[Conduct]** periodic on-site commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."
 4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the construction schedule. Update schedule at specified intervals.
 5. Review and comment on preliminary test procedures and data forms.
 6. Report inconsistencies and issues in system operations.
 7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
 8. Direct and coordinate test demonstrations.
 9. Coordinate witnessing of test demonstrations by Owner's witness.
 10. Coordinate and manage training. Be present during training sessions to direct video recording, present training and direct the training presentations of others. Comply with requirements in Section 017900 "Demonstration and Training."
 11. Prepare and submit specified commissioning reports.
 12. Track commissioning issues until resolution and retesting is successfully completed.
 13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.
 14. Assemble and submit commissioning report.

3.5 COMMISSIONING TESTING

- A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.
- B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published commissioning schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning.
- C. Construction Checklists:
1. Complete construction checklists as Work is completed.
 2. Distribute construction checklists to installing contractors before they start work.
 3. Installers:

- a. Verify installation using approved construction checklists as Work proceeds.
 - b. Complete and sign construction checklists [**daily**] [**weekly**] <Insert frequency> for work performed during the preceding [**day**] [**week**] <Insert time period>.
4. Provide Commissioning Authority access to construction checklists.
- D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.
- E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.
- F. Test Procedures and Test Data Forms:
 1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.
 2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
 3. Completed test data forms are the official records of the results of tests.
 4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
 5. Review preliminary test procedures and test data forms and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:
 - a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
 - b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.
 6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
 7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.
- G. Performance of Tests:
 1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
 2. Perform and complete each step of the approved test procedures in the order listed.
 3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.

4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:

1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be [100] <Insert number> percent unless otherwise indicated in the individual test specification.
2. Notify Owner's witness at least [three days] <Insert alternative time> in advance of each test demonstration.
3. Perform and complete each step of the approved test procedures in the order listed.
4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.
6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.
 - a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.
7. False load test requirements are specified in related sections.
 - a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Architect's written approval.

I. Deferred Tests:

1. Deferred Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction Phase Commissioning Completion.

Identify proposed deferred tests in the request for Certificate of Construction Phase Commissioning Completion as follows:

- a. Identify deferred tests by number and title.
 - b. Provide a target schedule for completion of deferred tests.
2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Architect and Commissioning Authority at least **[three working days]** <Insert alternative time> (minimum) in advance of tests.
 3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

J. Delayed Tests:

1. Delayed Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction Phase Commissioning Completion. Include the following in the request for Certificate of Construction Phase Commissioning Completion:
 - a. Identify delayed tests by test number and title.
 - b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.
2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Architect and Commissioning Authority at least **[three working days]** <Insert alternative time> (minimum) in advance of tests.
3. Where delayed tests are approved, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

K. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.
2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:
 - a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.

- b. Submit commissioning compliance issue report form within [24 hours] <Insert alternative time> of the test.
 - c. Determine the cause of the failure.
 - d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.
5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.
 - a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
 - b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.
 - c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
 - d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.
6. Diagnose and correct failed test demonstrations as follows:
 - a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
 - b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
 - c. Record the results of each step of the diagnostic procedure.
 - d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
 - e. Determine and record corrective measures.
 - f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.
7. Retest:
 - a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.
 - b. For each repeated test demonstration, submit a new test data form, marked "Retest."
8. Do not correct commissioning compliance issues during test demonstrations.

- a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than [five] <Insert number> minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

3.6 COMMISSIONING MEETINGS

- A. Commissioning Authority will schedule and conduct commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."

3.7 SEQUENCING

- A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:
 1. Construction Checklists:
 - a. Material checks.
 - b. Installation checks.
 - c. Start up, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.
 - d. Performance Tests:
 - 1) Static tests, as appropriate.
 - 2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
 - 3) Equipment and assembly performance tests.
 - 4) System performance tests.
 - 5) Intersystem performance tests.
 2. Commissioning tests.
- B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.
- C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.
- D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.8 SCHEDULING

- A. Commence commissioning as early in the construction period as possible.
- B. Commissioning Schedule: Integrate commissioning into Contractor's construction schedule. See Section 013200 "Construction Progress Documentation."
 - 1. Include detailed commissioning activities in monthly updated Contractor's construction schedule and short interval schedule submittals.
 - 2. Schedule the start date and duration for the following commissioning activities:
 - a. Submittals.
 - b. Preliminary operation and maintenance manual submittals.
 - c. Installation checks.
 - d. Startup, where required.
 - e. Performance tests.
 - f. Performance test demonstrations.
 - g. Commissioning tests.
 - h. Commissioning test demonstrations.
 - 3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
 - 4. Determine milestones and prerequisites for commissioning. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short interval schedule submittals.
- C. Two-Week Look-Ahead Commissioning Schedule:
 - 1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning.
 - 2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
 - 3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.
- D. Owner's Witness Coordination:
 - 1. Coordinate Owner's witness participation via Architect.
 - 2. Notify Architect of commissioning schedule changes at least five work days in advance for activities requiring the participation of Owner's witness.

3.9 COMMISSIONING REPORTS

- A. Test Reports:
 - 1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:

- a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
 - b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
 - c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
 - d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
 - e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.
2. Test data reports include the following:
- a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
 - b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
 - c. Signatures of individuals performing and witnessing tests.
 - d. Data trend logs accumulated overnight from the previous day of testing.
3. Commissioning Compliance Issues Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:
- a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
 - b. Action distribution list.
 - c. Report date.
 - d. Test number and description.
 - e. Equipment identification and location.
 - f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
 - g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
 - h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
 - i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.

- j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
 - k. Schedule for retesting.
4. Weekly progress reports include information for tests conducted since the preceding report and the following:
- a. Completed data forms.
 - b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
 - c. Activities scheduled but not conducted per schedule.
 - d. Commissioning compliance issue report log.
 - e. Schedule changes for remaining Commissioning-Process Work, if any.
5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.
- a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
 - b. Attach to the data form printed trend log data collected during the test or test demonstration.
 - c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.
6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."
- a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.10 CERTIFICATE OF CONSTRUCTION PHASE COMMISSIONING COMPLETION

- A. When Contractor considers that construction phase commissioning, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Architect a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning.

- B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction phase commissioning or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction Phase Commissioning Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction Phase Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction phase commissioning completion.
- C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.
- D. When construction phase commissioning or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction Phase Commissioning that shall establish the date of completion of construction phase commissioning. Certificate of Construction Phase Commissioning Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

END OF SECTION 019113

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Demolition and removal of buildings and site improvements.

- B. Related Requirements:

- 1. Section 011000 "Summary" for use of the premises and phasing requirements.
 - 2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
 - 3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse . Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site .
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.
 - 5. Review procedures for noise control and dust control.
 - 6. Review procedures for protection of adjacent buildings.
 - 7. Review items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Building Demolition Activities: Indicate the following:
 - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - 2. Temporary interruption of utility services.
 - 3. Shutoff and capping or re-routing of utility services.
- E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before the Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before building demolition, Owner will remove the following items:
 - a. **<Insert items to be removed by Owner>**.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Hazardous Materials: Present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - 3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.
- F. On-site storage or sale of removed items or materials is not permitted.

1.10 COORDINATION

- A. Arrange demolition schedule so as not to interfere with operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 DEMOLITION CONTRACTOR

- A. Demolition Contractor:
 - 1. **<Insert, in separate subparagraphs, name of Contractor prequalified to perform the Work of this Section>.**

3.2 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with Section 013233 "Photographic Documentation.

3.3 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Salvaged Items: Comply with the following:
 - 1. Clean salvaged items of dirt and demolition debris.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 - 1. Owner will arrange to shut off utilities when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - 4. Cut off pipe or conduit a minimum of **24 inches (610 mm)** below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
 - 5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.5 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 - 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

- a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."
1. Protect adjacent buildings and facilities from damage due to demolition activities.
 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.6 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 2. Maintain fire watch during and for at least <Insert number> hours after flame-cutting operations.
 3. Maintain adequate ventilation when using cutting torches.
 4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

- C. Explosives: Use of explosives is not permitted.

3.7 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending [**5 feet (1.5 m)**] <Insert dimension> outside footprint indicated for new construction. Abandon below-grade construction outside this area.
- D. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within **5 feet (1.5 m)** outside footprint indicated for new construction. Abandon utilities outside this area.
- E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
- F. Hydraulic Elevator Systems: Demolish and remove elevator system, including cylinder, plunger, well assembly, steel well casing and liner, oil supply lines, and tanks.

3.8 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with recycled pulverized concrete or recycled pulverized masonry according to backfill requirements in Section 312000 "Earth Moving."
- C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.9 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.11 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The project is required to be constructed to meet LEED Silver without obtaining LEED Silver Certification.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
 - 5. Concrete toppings.
 - 6. Building frame members.
 - 7. Building walls.
- B. Related Sections include the following:
 - 1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- E. Samples: For waterstops.
- F. Welding certificates.
- G. Qualification Data: For Installer.
- H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- I. Material Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Fiber reinforcement.
 6. Waterstops.
 7. Curing compounds.
 8. Floor and slab treatments.
 9. Bonding agents.
 10. Adhesives.
 11. Vapor retarders.
 12. Semirigid joint filler.
 13. Joint-filler strips.
 14. Repair materials.
- J. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- K. Field quality-control test and inspection reports.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. **Testing Agency Qualifications:** An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- C. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- D. **Welding:** Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- E. **ACI Publications:** Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. **Concrete Testing Service:** Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. **Mockups:** Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 - 1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade in the location indicated or, if not indicated, as directed by Architect.
 - 2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. **Preinstallation Conference:** Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

- a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Concrete subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

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, products specified.
 2. 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 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 1. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.

- d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 82, galvanized.

- E. Deformed-Steel Wire: ASTM A 496.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I, gray.
 - a. Fly Ash: ASTM C 618, Class C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330, 3/4-inch (19-mm) nominal maximum aggregate size.
- E. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
1. Available Products:
 - a. Boral Material Technologies, Inc.; Boral BCN.
 - b. Euclid Chemical Company (The); Eucon CIA.
 - c. Grace Construction Products, W. R. Grace & Co.; DCI.
 - d. Master Builders, Inc.; Rheocrete CNI.
 - e. Sika Corporation; Sika CNI.
- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Available Products:
 - a. Axim Concrete Technologies; Catexol 1000CI.
 - b. Boral Material Technologies, Inc.; Boral BCN2.
 - c. Cortec Corporation; MCI 2005NS.
 - d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
 - e. Master Builders, Inc.; Rheocrete 222+.
 - f. Sika Corporation; FerroGard-901.

- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. Available Manufacturers:
 - a. Bayer Corporation.
 - b. ChemMasters.
 - c. Conspec Marketing & Manufacturing Co., Inc.; a Dayton Superior Company.
 - d. Davis Colors.
 - e. Elementis Pigments, Inc.
 - f. Hoover Color Corporation.
 - 2. Color: Match Architect's sample.

2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Available Manufacturers:
 - a. Greenstreak.
 - b. Progress Unlimited, Inc.
 - c. Williams Products, Inc.
 - 2. Profile: As indicated.
- B. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Available Manufacturers:
 - a. Bometals, Inc.
 - b. Greenstreak.
 - c. Meadows, W. R., Inc.
 - d. Murphy, Paul Plastics Co.
 - e. Progress Unlimited, Inc.
 - f. Tamms Industries, Inc.
 - g. Vinylex Corp.
 - 2. Profile: As indicated.
- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

1. Available Products:
 - a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
 - b. Concrete Sealants Inc.; Conseal CS-231.
 - c. Greenstreak; Swellstop.
 - d. Henry Company, Sealants Division; Hydro-Flex.
 - e. JP Specialties, Inc.; Earthshield Type 20.
 - f. Progress Unlimited, Inc.; Superstop.
 - g. TCMiraDRI; Mirastop.

2.8 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 1. Available Products:
 - a. Fortifiber Corporation; Moistop Ultra.
 - b. Raven Industries Inc.; Vapor Block 15.
 - c. Stego Industries, LLC; Stego Wrap, 15 mils.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.9 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch (9.5-mm) sieve.
 1. Available Products:
 - a. Anti-Hydro International, Inc.; Emery.
 - b. Dayton Superior Corporation; Emery Non-Slip.
 - c. Emeri-Crete, Inc.; Emeri-Topcrete.
 - d. Lambert Corporation; EMAG-20.
 - e. L&M Construction Chemicals, Inc.; Grip It.
- B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
 1. Available Products:
 - a. Anti-Hydro International, Inc.; A-H Alox.

- b. L&M Construction Chemicals, Inc.; Grip It AO.
 - c. Sonneborn, Div. of ChemRex; Frictex NS.

- C. Emery Dry-Shake Floor Hardener: Pigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
 - 1. Color: Match Architect's sample.

- D. Metallic Dry-Shake Floor Hardener: Pigmented, factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.
 - 1. Color: Match Architect's sample.

- E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.
 - 1. Available Products:
 - a. Burke by Edoco; NonMetallic Floor Hardener.
 - b. ChemMasters; Concolor.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conshake 500.
 - d. Dayton Superior Corporation; Quartz Tuff.
 - e. Euclid Chemical Company (The); Surfex.
 - f. Kaufman Products, Inc.; Tycron.

- F. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 - 1. Available Products:
 - a. Burke by Edoco; NonMetallic Floor Hardener-Color.
 - b. ChemMasters; Concolor.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conshake 600 Colortone.
 - d. Dayton Superior Corporation; Quartz Tuff.
 - e. Euclid Chemical Company (The); Surfex.
 - 2. Color: Match Architect's sample.

- G. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Available Products:

- a. Burke by Edoco; Titan Hard.
- b. ChemMasters; Chemisil Plus.
- c. ChemTec International; ChemTec One.
- d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
- e. Curecrete Distribution Inc.; Ashford Formula.

2.10 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 1. Available Products:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edoco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 1. Available Products:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. Burke by Edoco; Aqua Resin Cure.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating.
 1. Available Products:
 - a. Anti-Hydro International, Inc.; AH Clear Cure WB.
 - b. Burke by Edoco; Spartan Cote WB II.

- c. ChemMasters; Safe-Cure & Seal 20.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
 - e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating.
- 1. Available Products:
 - a. Burke by Edoco; Spartan Cote WB II 20 Percent.
 - b. ChemMasters; Safe-Cure Clear.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
 - d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
 - e. Euclid Chemical Company (The); Diamond Clear VOX.
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- 1. Available Products:
 - a. Burke by Edoco; Cureseal 1315.
 - b. ChemMasters; Spray-Cure & Seal Plus.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315.
 - d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
 - e. Euclid Chemical Company (The); Super Diamond Clear.
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- 1. Available Products:
 - a. Burke by Edoco; Cureseal 1315 WB.
 - b. ChemMasters; Polyseal WB.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
 - d. Euclid Chemical Company (The); Super Diamond Clear VOX.
 - e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.

2.11 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing; IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlay: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 10 percent.
 - 2. Ground Granulated Blast-Furnace Slag: 40 percent.
 - 3. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 40 percent.
 - 4. Silica Fume: 10 percent.
 - 5. Combined total of all pozzolanic materials: 50 percent
 - 6. Do not exceed 25 percent in slabs that will be hard-troweled.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi (24.1 MPa) at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
 - 4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m).
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
6. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
7. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (29.7 kg/cu. m).
8. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m).

C. All other concrete not specifically noted: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (24.1 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
6. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 CONCRETE MIXING

- A. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. (0.76 cu. m) 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. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.
 - 4. Install anchors as required for Loading Dock Bumpers.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.
- C. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 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, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view,.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- 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.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations 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 to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.
 1. Apply scratch finish to surfaces indicated.
- 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.
- D. Trowel Finish: After applying float finish, apply first troweling 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.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

3. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot- (3.05-m-) long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm)
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- 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-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Slip-Resistive 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. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in 1 or 2 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.
- H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:
1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer.
 2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
 3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 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 ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m 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 float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, 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 (300-mm) 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 (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
3. Curing Compound: Apply uniformly in 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. Maintain continuity of coating and repair damage during curing period.
- a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
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.

3.14 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than three days' old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's

- written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

END OF SECTION 033000

SECTION 042000
UNIT MASONRY

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.
- B. The project is required to be constructed to meet LEED Silver without obtaining LEED Silver Certification.

1.2 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units (CMUs).
 - 2. Decorative concrete masonry units.
 - 3. Acoustical concrete masonry units.
 - 4. Concrete brick.
 - 5. Face brick.
 - 6. Building (common) brick.
 - 7. Cavity-wall insulation.
 - 8. Mortar and grout.
 - 9. Reinforcing steel.
 - 10. Masonry joint reinforcement.
 - 11. Ties and anchors.
 - 12. Embedded flashing.
 - 13. Miscellaneous masonry accessories.
- B. Related Sections include the following:
 - 1. Division 04 Section "Glass Unit Masonry" for glass block.
 - 2. Division 07 Section "Bituminous Dampproofing" for dampproofing applied to cavity face of backup wythes of cavity walls.
 - 3. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
 - 4. Division 07 Section "Fire-Resistive Joint Systems" for fire-resistive joint systems at heads of masonry walls.
 - 5. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
 - 6. Division 08 Section "Louvers and Vents" for wall vents (brick vents).
- C. Products furnished, but not installed, under this Section include the following:

1. Dovetail slots for masonry anchors, installed under Division 03 Section "Cast-in-Place Concrete."
2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 05 Section "Structural Steel Framing."

D. Products installed, but not furnished, under this Section include the following:

1. Cast-stone trim, furnished under Division 04 Section "Cast Stone."
2. Steel lintels and shelf angles for unit masonry, furnished under Division 05 Section "Metal Fabrications."
3. Manufactured reglets in masonry joints for metal flashing, furnished under Division 07 Section "Sheet Metal Flashing and Trim."

E. Allowances: The following are included under the allowances indicated as specified in Division 01 Section "Allowances":

1. Face brick under the Face Brick Allowances.
2. Preconstruction and field quality-control testing under Testing and Inspecting Allowance.

1.3 DEFINITIONS

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

1.4 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." Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection: For the following:

1. Decorative concrete masonry units, in the form of small-scale units.
2. Face brick, in the form of straps of five or more bricks.
3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Exposed concrete masonry units.
2. Acoustical concrete masonry units.
3. Face brick.

4. Special brick shapes.
 5. Weep holes/vents.
 6. Accessories embedded in masonry.
- E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- F. Qualification Data: For testing agency.
- G. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
 - d. For surface-coated brick, include material test report for durability of surface appearance after 50-cycles of freezing and thawing per ASTM C 67.
 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.
- H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- 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, through one source from a 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 a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
 - 1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
 - 2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
 - 3. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
 - 4. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.
 - 1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.
 - 2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
 - 3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
 - 4. Protect approved sample panels from the elements with weather-resistant membrane.
 - 5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for typical exterior and interior walls in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches (400 mm) long in each mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
 - c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.
3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 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 lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on

elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

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

1.7 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 (600 mm) down both sides and hold cover securely in place.
 - 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 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.
- D. 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 (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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, products specified.
 2. 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 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (CMUs)

- A. **Aggregates: Provide one of the following type to meet required fire rating, no substitution permitted:**
1. **Expanded slag or pumice, 3-5/8" minimum face to face thickness, 2 hour fire rated.**
 2. **Expanded clay, shale or slate, 3-5/8" minimum face to face thickness, 2 hour fire rated.**
- B. Shapes: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bull-nose units at all exposed corners.
- C. Integral Water Repellent: Provide units made with integral water repellent where indicated.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
 - a. Available Products:
 - 1) Addiment Incorporated; Block Plus W-10.
 - 2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.

3) Master Builders, Inc.; Rheopel.

D. Concrete Masonry Units: ASTM C 90.

1. Weight Classification: Lightweight.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

E. Decorative Concrete Masonry Units: ASTM C 90.

1. Weight Classification: Lightweight.
2. Size (Width): Manufactured to dimensions specified in "Concrete Masonry Units" Paragraph above.
3. Pattern and Texture:
 - a. Standard pattern, ground finish. Match Architect's samples.
 - b. Standard pattern, split-face finish. Match Architect's samples.
 - c. Standard pattern, split-ribbed finish. Match Architect's samples.
 - d. Scored vertically so units laid in running bond appear as square units laid in stacked bond, standard finish. Match Architect's samples.
 - e. Triple scored vertically so units laid in running bond appear as vertical units laid in stacked bond (soldier courses), standard finish. Match Architect's samples.
4. Colors: Match Architect's samples.
5. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

F. Concrete Building Brick: ASTM C 55.

1. Weight Classification: Lightweight.
2. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.

2.4 ACOUSTICAL CONCRETE MASONRY UNITS

- A. General: The Acoustical Concrete Masonry Unit shall be the model "DiffuserBlox dB12S" with a resonator slot as manufactured by RPG Diffuser Systems, Inc., 651-C Commerce Drive, Upper Marlboro, MD 20774. Tel: 301-249-0044, Fax: 301-249-3912.
- B. The acoustical Concrete Masonry Unit shall conform to the following:
 1. For hollow load bearing units, ASTM C-90 for grade N, Type I or Type II units with exceptions noted herein.

2. For hollow non-load bearing units, ASTM C-129 for Grade N, Type I or Type II units, with the exceptions noted herein.
3. DiffuserBlox constituent shall conform to the following ASTM:
 - a. Portland Cemet: ASTM C-150
 - b. Blended Cements: ASTM C-595
 - c. Hydrated Lime, Type S: ASTM C-207+
 - d. Pozzolans: ASTM C-618
 - e. Aggregate: ASTM C-331 or C-33, based on local availability
- C. Other concrete unit constituents such as air-entering agents, pigments, water repellents, silica, etc. may be used provided their suitability for use in concrete has been established either by inclusion in ASTM standards or through test and experience records substantiating that such particular mixtures and their proportions are not detrimental to the durability and/or performance of DiffuserBlox units.
- D. The Acoustical Concrete Masonry Unit shall work on the one dimensional reflection phase grating principle, using an array of wells of equal width separated by dividers. The depths of the wells shall be based on the prime 7 quadratic residue theory sequence. A full sequence is achieved by alternating two types of block designated as Type A and Type B.
- E. Sound diffusion in the horizontal plane shall be provided by wells in the vertical position.
- F. Absorption coefficients and noise reduction coefficient for the product shall be measured by an independent, accredited NVLAP facility according to the test methods as defined by ASTM C 423 and ASTM E 795. Random incidence absorption coefficients for the product in a type A mounting shall be as follows:

	125 Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	NRC
Unfinished, stained, 0.98 or lightly painted	0.90	0.93	0.77	0.80	0.77	0.85	
Fully sealed	0.76	0.51	0.57	0.34	0.24	0.26	0.41

- G. Transmission Loss (TL) and Sound Transmission Class (STC) for the produce shall be measured by an independent, accredited NVLAP facility according to the test methods as defined by ASTM E 90 and /ASTM E 413 TL and STC values for the produce shall be as follows:

	125 Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	NRC
Fully sealed	44	45	52	57	61	64	55

- H. Diffusion Coefficients for the product shall be measured in accordance with AES-4id-2001. The normal incidence Diffusion Coefficients are listed below t octave-band centers. The mean and standard deviation (SD) of the 1/3-octave-band coefficients are also tabulated.

125 Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	MEAN	SD
0.63	0.69	0.74	0.71	0.70	0.74	0.70	0.07

- I. Where fire rated assemblies are indicated, materials shall be tested by an independent, accredited NVLAP facility according to the test methods as defined by ASTM E 119 and NFPA 251.
- J. Inset insulation shall be semi-rigid fiberglass conforming to ASTM C 1071, having 6.0 lb. Per cubic foot density, and a Class A fire rating, each individually shaped to conform to the concrete block cores. Fiberglass inserts shall be pre-installed at the block plant prior to delivery.
- K. The overall dimensions shall be 7-5/8" (H) x 15-5/8" (W) x 11-5/8" (D).

2.5 CONCRETE AND MASONRY LINTELS

- A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
- B. Concrete Lintels: Precast units made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by same method used for concrete masonry units.
- C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete."
- D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 BRICK

- A. General: Provide shapes indicated and as follows:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade MW or SW.

1. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
3. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
4. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.
5. Color and Texture: Match Architect's samples.

2.7 MORTAR AND GROUT MATERIALS

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

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

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 (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Available Products:

- a. Addiment Incorporated; Mortar Kick.
- b. Euclid Chemical Company (The); Accelguard 80.
- c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
- d. Sonneborn, Div. of ChemRex; Trimix-NCA.

- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
1. Available Products:
 - a. Addiment Incorporated; Mortar Tite.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
 - c. Master Builders, Inc.; Color Cure Mortar Admix.
- H. Water: Potable.

2.8 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951.
1. Interior Walls: Mill- Hot-dip galvanized, carbon steel.
 2. Exterior Walls: Hot-dip galvanized, carbon Stainless steel.
 3. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
 4. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
 5. Wire Size for Veneer Ties: W1.7 or 0.148-inch (3.8-mm) diameter.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 7. 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: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod at each wythe of masonry 4 inches (100 mm) or less in width.
 2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
 3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.9 TIES AND ANCHORS

- A. **Materials:** Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with the subparagraphs below, unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
 3. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
 4. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
 5. Stainless-Steel Sheet: ASTM A 666, Type 304.
 6. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. **Corrugated Metal Ties:** Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from steel sheet, galvanized after fabrication not less than 0.043 inch (1.1 mm) thick. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated.
- C. **Wire Ties, General:** Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- D. **Individual Wire Ties:** Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
 3. Wire: Fabricate from 3/16-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
- E. **Adjustable Anchors for Connecting to Structure:** Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.
 2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
 3. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.
 4. Tie Section for Concrete: Corrugated metal ties with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch (25 mm) of masonry face.

- F. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins, unless otherwise indicated.
 - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- H. Adjustable Masonry-Veneer Anchors
 - 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
 - 2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
 - 3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
 - b. Anchor Section: Sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch (16 mm) wide by 3-5/8 inches (92 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - c. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - d. Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - e. Fabricate sheet metal anchor sections and other sheet metal parts from 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.

- f. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.25-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.
 - g. Available Products:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708.
 - 2) Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
 - 3) Hohmann & Barnard, Inc.; DW-10 DW-10HS or DW-10-X.
 - 4) Wire-Bond; 1004, Type III or RJ-711.
4. Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and an anchor section designed to interlock with metal studs and be slipped into place as sheathing is installed.
- a. Wire-Type Anchor: Bent wire anchor section with an eye to receive the wire tie. Wire tie has a vertical leg that slips into the eye of anchor section and allows vertical adjustment. Both sections are made from 3/16-inch (4.8-mm), hot-dip galvanized wire.
 - b. Strap-and-Wire Type Anchor: Flat metal strap with notch to interlock with flange of metal stud and two holes for inserting vertical legs of wire tie specially formed to fit anchor section. Strap is made from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication; anchor wire tie is made from 3/16-inch (4.8-mm), hot-dip galvanized wire.
 - c. Available Products:
 - 1) BLOK-LOK Limited; STUD-LOK.
 - 2) Hohmann & Barnard, Inc.; AA308.
5. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
- a. Available Products:
 - 1) ITW Buildex; Teks Maxiseal with Climaseal finish.
 - 2) Textron Inc., Textron Fastening Systems; Elco Dril-Flex with Stalgard finish.
6. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.
- a. Available Products:

- 1) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
- 2) ITW Buildex; Scots long life Tekes.

2.10 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.9-mm), galvanized steel sheet.
- C. Anchor Bolts: L-shaped 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; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- D. Postinstalled Anchors: Provide torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
 2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.11 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.4 mm) thick.
 2. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.34 mm) thick for fully concealed flashing; 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick elsewhere.
 3. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.
 4. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.
 - a. Available Products:
 - 1) Cheney Flashing Company; Cheney Flashing (Dovetail) or Cheney 3-Way Flashing (Sawtooth).

- 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
 5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 6. Fabricate through-wall flashing with drip edge, unless otherwise indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
 7. Fabricate through-wall flashing with sealant stop, unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
 8. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches (75 mm) into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
 9. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.12 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes. Use only for weeps.
 2. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (9-mm) OD by 4 inches (100 mm) long.
 3. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
 4. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Available Products:
 - 1) Advanced Building Products Inc.; Mortar Maze weep vent.

- 2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 3) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 4) Hohmann & Barnard, Inc.; Quadro-Vent.
 - 5) Wire-Bond; Cell Vent.
 5. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Available Products:
 - 1) Mortar Net USA, Ltd.; Mortar Net Weep Vents.
 6. Aluminum Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel with louvers stamped in web and with a top flap to keep mortar out of the head joint; painted before installation to comply with Division 09 painting Sections in color approved by Architect to match that of mortar.
 - a. Available Products:
 - 1) Hohmann & Barnard, Inc.; #343W - Wilko Weep Hole.
 7. Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color approved by Architect to match that of mortar.
 - a. Available Products:
 - 1) Hohmann & Barnard, Inc.; #343 Louvered Weep Hole.
 - 2) Williams Products, Inc.; Williams-Goodco Brick Vent.
 - 3) Wire-Bond; Louvered Weepholes.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep that prevent mesh from being clogged with mortar droppings.
 - b. Strips, not less than 3/4 inch (19 mm) thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - c. Sheets or strips full depth of cavity and installed to full height of cavity.
 - d. Sheets or strips not less than 3/4 inch (19 mm) thick and installed to full height of cavity with additional strips 4 inches (100 mm) high at weep holes and thick

enough to fill entire depth of cavity and prevent weep holes from being clogged with mortar.

2. Available Products:

- a. Advanced Building Products Inc.; Mortar Break.
- b. Archovations, Inc.; CavClear Masonry Mat.
- c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
- d. Mortar Net USA, Ltd.; Mortar Net.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Available Products:

- a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
- b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
- c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
- d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.13 CAVITY-WALL INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil-faced), Class 2 (glass-fiber-reinforced).
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.14 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Manufacturers:

- a. Diedrich Technologies, Inc.
- b. EaCo Chem, Inc.
- c. ProSoCo, Inc.

2.15 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. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 - 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, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
- D. 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.
 - 3. For mortar parge coats, use Type S or 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.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- E. 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 (200 to 280 mm) as measured according to ASTM C 143/C 143M.

2.16 SOURCE QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
 - 1. Payment for these services will be made by Owner.
 - 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Clay Masonry Unit Test: For each type of unit furnished, per ASTM C 67.

- C. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

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 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. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. 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.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

- H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
1. 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
 3. 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
 7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.3 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 bond pattern indicated on Drawings; 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 (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) 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, remove loose masonry units and mortar, and wet brick if required 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 concrete masonry units with grout 24 inches (600 mm) 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. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c., unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. 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."

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and concrete masonry units 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. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

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

3.5 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
 - 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. (0.25 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use tab-type reinforcement.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches (76 mm) into each wythe. Space headers not over 8 inches (203 mm) clear horizontally and 16 inches (406 mm) clear vertically.
- B. Bond wythes of composite masonry together using bonding system indicated on Drawings.
- C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
 - 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 - 1. Provide individual metal ties not more than 16 inches (406 mm) o.c.
 - 2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
 - 3. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. (0.25 sq. m) of wall area spaced not to exceed 36 inches (914 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use tab-type reinforcement.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches (76 mm) into each wythe. Space headers not over 8 inches (203 mm) clear horizontally and 16 inches (406 mm) clear vertically.
 4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.
- E. Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing."
- F. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 1. Space reinforcement not more than 16 inches (406 mm) o.c.
 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
 - a. Reinforcement above is 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.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 1. Provide an open space not less than 1/2 inch (13 mm) in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
3. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
5. Space anchors as indicated, but not more than 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.
6. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. (0.25 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.11 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick made from clay or shale as follows:
 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 3. Build in compressible joint fillers where indicated.
 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch (10 mm).
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm) on interior face.
 - 3. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and 1-1/2 inches (38 mm) into the inner wythe. Form 1/4-inch (6-mm) hook in edge of flashing embedded in inner wythe.
 - 4. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
 - 5. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
 - 6. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with

- elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
7. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products or open head joints to form weep holes.
 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
 4. Space weep holes formed from plastic tubing or wicking material 16 inches (400 mm) o.c.
 5. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
 6. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.
1. Fill cavities full height by placing pea gravel in cavities as masonry is laid so that at any point masonry does not extend more than 24 inches (600 mm) above top of pea gravel.
- F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- G. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.14 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

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

C. 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 (1520 mm).

3.15 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.

D. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.

E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

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

G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.16 PARING

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.

3.17 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. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.18 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 042000

SECTION 051200
STRUCTURAL STEEL FRAMING

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.
- B. The project is required to be constructed to meet LEED Silver without obtaining LEED Silver Certification.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Steel Decking" for field installation of shear connectors.
 - 3. Division 05 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame and other metal items not defined as structural steel.
 - 4. Division 09 painting Sections and Division 09 Section "High-Performance Coatings" for surface preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.

2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.
- B. Construction: Type PR, partially restrained.
- C. Construction: Type 2, simple framing.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 2. Include embedment drawings.
 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 5. For structural-steel connections 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: For Installer fabricator professional engineer and testing agency.
- E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
1. Structural steel including chemical and physical properties.
 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 3. Direct-tension indicators.
 4. Tension-control, high-strength bolt-nut-washer assemblies.
 5. Shear stud connectors.
 6. Shop primers.
 7. Nonshrink grout.
- F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
 - 3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 - 4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
 - 5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 - 6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B C, structural tubing.

- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: Standard.
 - 2. Finish: Black, except where indicated to be galvanized.

- F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
 - 1. Finish: Plain.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8.) compressible-washer type.
 - a. Finish: Plain.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers, plain.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M,) Type 10.9, compressible-washer type, plain.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- E. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Hooked.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 5. Finish: Plain.
- F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.

2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
4. Finish: Plain.

G. Threaded Rods: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6).

1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain.

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
- B. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

- A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 1. Camber structural-steel members where indicated.
 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 3. Mark and match-mark materials for field assembly.
 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.
- I. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Slip critical.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.

- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

- D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
 - 1. Fill vent holes and grind smooth after galvanizing.
 - 2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 05210 - STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. K-series steel joists.
 - 2. KCS-type K-series steel joists.
 - 3. Long-span steel joists.
 - 4. Joist accessories.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for installing bearing plates in concrete.
 - 2. Division 4 Section "Unit Masonry Assemblies" for installing bearing plates in unit masonry.

1.3 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by the manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables SJI's "Specifications."

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
- B. Design special joists to withstand design loads with live load deflections no greater than the following:
 - 1. Floor Joists: Vertical deflection of 1/360 of the span.
 - 2. Roof Joists: Vertical deflection of 1/360 of the span.

1.5 SUBMITTALS

- A. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
 - 1. Indicate locations and details of bearing plates to be embedded in other construction.
 - 2. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- B. Welding Certificates.
- C. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirement.
- D. Mill certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.
- E. Research/Evaluation Reports: For joists.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. SJI Specifications: Comply with standard specifications in SJI's "that are applicable to types of joists indicated.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code—Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Recycled Content: Provide steel containing minimum 30 percent total recycled content.
- B. Local Materials: Provide products manufactured and of primary materials extracted/ harvested/ recovered within a 500-mile radius of the project site.
- C. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.
- D. Steel Bearing Plates: ASTM A 36/A 36M.
- E. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated.
- F. High-Strength Bolts, Nuts, and Washers: ASTM A 325 , Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- G. Welding Electrodes: Comply with AWS standards.
- H. Galvanizing Repair Paint: ASTM A 780.
 - 1. VOC Content shall not exceed 150 g/l.

2.2 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15, except where indicated otherwise.
 - 1. Exposed Steel Joists: Provide shop primer that complies with Division 9 painting sections of steel joists to remain exposed.

2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

- C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- D. Provide holes in chord members for connecting and securing other construction to joists.
- E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- G. Camber joists according to SJI's "Specifications."
- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 LONG-SPAN STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated.
 - 1. Joist Type: LH-series steel joists and DLH-series steel joists.
 - 2. End Arrangement: Underslung.
 - 3. Top-Chord Arrangement: As indicated on drawings.
- B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Camber long-span steel joists according to SJI's "Specifications."
- E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.5 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing and span. Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

- C. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."
- D. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.
- E. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.6 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive, unless shop priming is approved by sprayed fire-resistive materials manufacturer.
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.
- D. Shop priming of joists and joist accessories in pool environment area is specified in Division 9 Section "High-Performance Coatings."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.

3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.
- E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Construction Manager will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Field welds will be visually inspected according to AWS D1.1/D1.1M.
- C. In addition to visual inspection, field welds will be tested according to AWS D1.1/D1.1M and the following procedures, as applicable:
1. Radiographic Testing: ASTM E 94.
 2. Magnetic Particle Inspection: ASTM E 709.
 3. Ultrasonic Testing: ASTM E 164.
 4. Liquid Penetrant Inspection: ASTM E 165.
- D. Bolted connections will be visually inspected.
- E. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's " Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- F. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- G. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates and abutting structural steel.
 - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
 - 3. Cleaning and touchup painting for steel joists in pool environment are specified in Division 9 Section "High-Performance Coating."
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05210

SECTION 053100

STEEL DECKING

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.
- B. The project is required to be constructed to meet LEED Silver without obtaining LEED Silver Certification.

1.2 SECTION INCLUDES

- A. Acoustical roof deck.
- B. Roof deck.
- C. Composite floor deck.
- D. Supplementary framing for openings up to and including 12 inches.
- E. Bearing plates and angles.
- F. Stud shear connectors.
- G. Acoustical insulation in roof deck flutes.

1.3 REFERENCE STANDARDS

- A. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
- C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society.
- F. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society.
- G. SDI (DM) - Publication No.31, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute.

- H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); The Society for Protective Coatings.

1.4 PERFORMANCE REQUIREMENTS

- A. Select and design metal deck in accordance with SDI Design Manual.
- B. Calculate to structural working stress design and structural properties specified.
- C. Maximum Vertical Deflection of Floor Deck: 1/360.
- D. Maximum Vertical Deflection of Roof Deck: 1/240.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, cellular raceways and outlet box locations, pertinent details, and accessories.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Certificates: Certify that products furnished meet or exceed specified requirements.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. United Steel Deck , Inc: www.njb-united.com.
- B. Nucor-Vulcraft Group: www.vulcraft.com.
- C. Wheeling Corrugating Co: www.wheelingcorrugating.com.

2.2 STEEL DECK

- A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.

1. Calculate to structural working stress design and structural properties specified.
2. Maximum Vertical Deflection of Floor Deck: 1/360.
3. Maximum Vertical Deflection of Roof Deck: 1/240.
4. Regional Content: Give preference to products manufactured and of primary raw materials within 500 miles of Project Site.
5. Recycled Content: Provide steel deck with minimum 30 percent recycled content, of which minimum 25 percent shall be post-consumer recycled content.

B. Roof Deck: Non-composite type, fluted steel sheet:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), with G90/Z275 galvanized coating.
 - a. Grade 33.

C. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), with G60/Z180 minimum.
 - a. Grade 33.

D. Metal Form Deck: Corrugated sheet steel:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Designation SS, with G90/Z275 galvanized coating.
 - a. Grade 80.

2.3 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A 36/A 36M steel.
- B. Stud Shear Connectors: Made from ASTM A 108 Grade 1015 bars.
- C. Welding Materials: AWS D1.1.
- D. Fasteners: Galvanized hardened steel, self tapping.
- E. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.
- F. Shop and Touch-Up Primer: Type specified in Section 09912, complying with VOC limitations of authorities having jurisdiction.
- G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
- H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.
- I. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck.

2.4 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage thick sheet steel; of profile and size as indicated; finished same as deck.
- B. Cant Strips: Formed sheet steel, 16 gage thick, 45 degree slope, 3 1/2 inch nominal width and height, flange for attachment.
- C. Roof Sump Pans: 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.
- D. Floor Drain Pans: 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On concrete and masonry surfaces provide minimum 4 inch bearing.
- C. On steel supports provide minimum 2 inch bearing.
- D. Place deck panels on supporting frame and adjust final position with ends accurately aligned and bearing on supporting frame, prior to fastening.
- E. Provide additional reinforcing and closure pieces at openings, as required for strength, continuity of deck, and support of other Work.
- F. Weld deck in accordance with AWS D1.3.
- G. Where deck changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.
- H. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.
- I. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- J. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

- K. Place metal cant strips in position and fusion weld.
- L. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- M. Position floor drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- N. Weld stud shear connectors through steel deck to structural members below.
- O. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.3 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long and as follows:
 - 1. Weld Diameter: 5/8 inch nominal.
 - 2. Weld Spacing: Weld edge ribs of panel at each support; space additional welds as indicated on Drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one quarter of the span or 18 inches and as indicated on Drawings.
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon steel screws.
 - 2. Fasten with a minimum of 1-1/2 inch-long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints lapped 2 inches minimum.

3.4 FLOOR DECK INSTALLATION

- A. Fasten floor deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch nominal.
 - 2. Weld Spacing: Weld edge ribs of panel at each support and at 12 inches on center.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half the span or 36 inches and as follows:
 - 1. Fasten with a minimum of 1-1/2 inch-long welds.
 - 2. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints butted.

3.5 FIELD QUALITY CONTROL

- A. Owner to engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspection includes, but not limited to, deck alignment, support, welds, side lap attachment and touch-up galvanizing.
- C. Testing agency will report inspection results promptly and in writing to Owner, Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 053100

SECTION 05 5113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.
4. Railing gates at the level of exit discharge.

- B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 055213 "Pipe and Tube Railings" for pipe and tube railings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. 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.
- C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:

1. Prefilled metal-pan-stair treads.
2. Precast concrete treads.
3. Epoxy-resin-filled stair treads.
4. Non-slip aggregates and non-slip-aggregate finishes.

5. Abrasive nosings.
6. Paint products.

B. Sustainable Design Submittals:

1. [<Double click to insert sustainable design text for recycled content.>](#)

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Verification: For each type and finish of nosing and tread.

E. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.

- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.5.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. [<Double click to insert sustainable design text for recycled content.>](#)
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- F. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.
- G. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.
- H. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial steel, Type B, or structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.
- I. Woven-Wire Mesh: Intermediate-crimp, square pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A 510 (ASTM A 510M).

2.3 ABRASIVE NOSINGS

- A. Cast-Metal Units: Cast iron, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
- B. Extruded Units: Bronze units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- D. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.
- E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, **ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**; with hex nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. bolts, **ASTM F 593 (ASTM F 738M)**, and nuts, **ASTM F 594 (ASTM F 836M)**.

2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.
- G. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- H. Welded Wire Reinforcement: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter.

- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.7 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers of steel plates or channels.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
 - 4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than **0.067 inch (1.7 mm)**.
- D. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than **0.097 inch (2.5 mm)**.
 - 1. Steel Sheet: Uncoated hot-rolled steel sheet unless otherwise indicated.
 - 2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
 - 3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
 - 4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.

2.8 STAIR RAILINGS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."
- B. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
- C. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

- D. Form changes in direction of railings as follows:
 - 1. As detailed.
 - 2. By bending.
 - 3. By flush bends.
 - 4. By radius bends of radius indicated.
- E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- F. Close exposed ends of railing members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.
- H. Connect posts to stair framing by direct welding unless otherwise indicated.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 - 3. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides **1-1/2-inch (38-mm)** clearance from inside face of handrail to finished wall surface.
- J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.
- H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055113

SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings.
- B. Related Requirements:
 - 1. Section 055112 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. 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.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for recycled content.>](#)

- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Samples: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting and finishing members at intersections.
- E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- F. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Tube Railings:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

- a. Uniform load of **50 lbf/ ft. (0.73 kN/m)** applied in any direction.
- b. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

- a. Concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**.
- b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C, material surfaces)**.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides **1-1/2-inch (38-mm)** clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

- A. [<Double click to insert sustainable design text for recycled content.>](#)
- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- F. Woven-Wire Mesh: Intermediate-crimp, square pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.134-inch- (3.42-mm-)** diameter wire complying with **ASTM A 510 (ASTM A 510M)**.

2.5 FASTENERS

- A. General: Provide the following:
 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5 for zinc coating.
 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group **1 (A1)** stainless-steel bolts, **ASTM F 593 (ASTM F 738M)**, and nuts, **ASTM F 594 (ASTM F 836M)**.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- H. Intermediate Coats and Topcoats: Provide products that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- K. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- L. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- M. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 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 flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- K. Form Changes in Direction as Follows:
 - 1. As detailed.
- L. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

- M. Close exposed ends of railing members with prefabricated end fittings.
- N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- Q. For railing posts set in concrete, provide stainless-steel sleeves not less than **6 inches (150 mm)** long with inside dimensions not less than **1/2 inch (13 mm)** greater than outside dimensions of post, with metal plate forming bottom closure.
- R. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- S. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into **1-by-1/2-by-1/8-inch (25-by-13-by-3-mm)** metal channel frames. Make wire mesh and frames from same metal as railings in which they are installed.
- T. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize indicated steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
- G. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."
- H. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3.5 m)**.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending **2 inches (50 mm)** beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within **6 inches (150 mm)** of post.

3.4 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than **5 inches (125 mm)** deep and **3/4 inch (20 mm)** larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- D. Leave anchorage joint exposed with **1/8-inch (3-mm)** buildup, sloped away from post.
- E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
 2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
 - 5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 - 6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood blocking, cants, and nailers.
 - 3. Plywood backing panels.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than **2 inches nominal (38 mm actual)** size in least dimension.
- B. Dimension Lumber: Lumber of **2 inches nominal (38 mm actual)** size or greater but less than **5 inches nominal (114 mm actual)** size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.

1.4 ACTION SUBMITTALS

- A. 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:

1. [<Double click to insert sustainable design text for regional materials.>](#)
2. [<Double click to insert sustainable design text for certified wood.>](#)
3. [<Double click to insert sustainable design text for certified wood.>](#)
4. [<Double click to insert sustainable design text for composite wood.>](#)
5. [<Double click to insert sustainable design text for installation adhesives.>](#)

C. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Power-driven fasteners.
3. Post-installed anchors.
4. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. 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.

B. [<Double click to insert sustainable design text for manufacturer qualifications.>](#)

C. [<Double click to insert sustainable design text for vendor qualifications.>](#)

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. [<Double click to insert sustainable design text for regional materials.>](#)

- B. [<Double click to insert sustainable design text for certified wood.>](#)
- C. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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. Dress lumber, S4S, unless otherwise indicated.
- D. Maximum Moisture Content of Lumber: [15 percent] [19 percent] [15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness] [15 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness] [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 LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that 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 all rough carpentry unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply 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 Lumber and 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. Treatment shall not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. 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.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all rough carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Rooftop equipment bases and support curbs.
 2. Cants.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
1. Hem-fir (north); NLGA.
 2. Mixed southern pine or southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Western woods; WCLIB or WWPA.
 7. Northern species; NLGA.
 8. Eastern softwoods; NeLMA.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C , fire-retardant treated, in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough 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 or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.7 METAL FRAMING ANCHORS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, **G60 (Z180)** coating designation.
 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185 (Z550)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.
 1. Use for wood-preservative-treated lumber and where indicated.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304.
 1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. 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.
- E. Install shear wall panels to comply with manufacturer's written instructions.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. 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.
- J. 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.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than **96 inches (2438 mm)** o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and **2-inch nominal (38-mm actual)** thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft. (9.3 sq. m)** and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than **20 feet (6 m)** o.c.
- K. Sort and select lumber so that natural characteristics do 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.
- L. Comply with AWWA 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.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.
- O. 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.
- P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
1. Comply with approved fastener patterns where applicable.
 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for 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 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.

- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 06 4113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Architectural wood cabinets.
- 2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
- 3. Shop finishing of architectural wood cabinets.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 ALLOWANCES

- A. Veneer for wood-veneer-faced architectural cabinets is part of veneer allowance. Allowance includes the cost of veneer that is wasted due to selection, cutting, and trimming.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .

1.5 ACTION SUBMITTALS

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

- 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- B. Sustainable Design Submittals:

- 1. [<Double click to insert sustainable design text for recycled content.>](#)
- 2. [<Double click to insert sustainable design text for regional materials.>](#)

3. [<Double click to insert sustainable design text for certified wood.>](#)
4. [<Double click to insert sustainable design text for adhesives.>](#)
5. [<Double click to insert sustainable design text for composite wood.>](#)

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

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood cabinets.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply WI Certified Compliance Program label to Shop Drawings.
6. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Shop-applied opaque finishes.
3. PVC edge material.
4. Thermoset decorative panels.

E. Samples for Verification:

1. Lumber for transparent finish, not less than **5 inches (125 mm)** wide by **12 inches (300 mm)** long , for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
3. Lumber and panel products with shop-applied opaque finish, **5 inches (125 mm)** wide by **12 inches (300 mm)** long for lumber and **8 by 10 inches (200 by 250 mm)** for panels, for each finish system and color, with one-half of exposed surface finished.
4. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, **18 inches (450 mm)** high by **18 inches (450 mm)** wide by **6 inches (150 mm)** deep.
 - b. Miter joints for standing trim.
5. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.6 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.

1.7 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.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical architectural wood cabinets as shown on Drawings .
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 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.

1.9 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 **[25 and 55] [43 and 70] [17 and 50]** <Insert humidity range> 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 coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.10 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087111 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

- A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of architectural wood cabinets with sequence-matched wood veneers [**wood paneling**] wood doors with face veneers that are sequence matched with woodwork and transparent-finished wood doors that are required to be of same species as woodwork.
- B. **Manufacturers:** Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 1. <Insert manufacturer's name>.

2.2 ARCHITECTURAL WOOD CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
 1. Provide labels and certificates from AWI certification program indicating that woodwork[, **including installation,**] complies with requirements of grades specified.
 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.3 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Grade: [**Premium**] [**Custom**] [**Economy**].
- B. <Double click to insert sustainable design text for regional wood materials.>

- C. [<Double click to insert sustainable design text for certified wood.>](#)
- D. Type of Construction: [**Frameless**] [**Face frame**].
- E. Cabinet and Door and Drawer Front Interface Style: [**Flush overlay**] [**Reveal overlay**] [**Lipped**] [**Flush inset**].
- F. Reveal Dimension: [**1/2 inch (13 mm)**] [**As indicated**] <Insert dimension>.
- G. Wood for Exposed Surfaces:[**As indicated.**]
1. Species: [**Red oak**] [**White oak**] [**White ash**] [**White birch**] <Insert species>.
 2. Cut: [**Plain sliced/plain sawn**] [**Rift cut/rift sawn**] [**Quarter cut/quarter sawn**].
 3. Grain Direction: [**Vertically for drawer fronts, doors, and fixed panels**] [**Horizontally for drawer fronts, doors, and fixed panels**] [**Vertically for doors and fixed panels, horizontally for drawer fronts**] [**As indicated**].
 4. Matching of Veneer Leaves: [**Book**] [**Slip**] [**Random**] match.
 5. Veneer Matching within Panel Face: [**Running**] [**Balance**] [**Center-balance**] match.
 6. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.
 7. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.
- H. Semiexposed Surfaces: Provide surface materials indicated below:
1. Surfaces Other Than Drawer Bodies: [**Same species and cut indicated for exposed surfaces**] [**Thermoset decorative panels**] [**Compatible species to that indicated for exposed surfaces, stained to match**].
 - a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 2. Drawer Subfronts, Backs, and Sides: [**Solid-hardwood lumber, same species indicated for exposed surfaces**] [**Solid-hardwood lumber, stained to match species indicated for exposed surfaces**] [**Solid-hardwood lumber**] [**Thermoset decorative panels with PVC or polyester edge banding**].
 3. Drawer Bottoms: [**Hardwood plywood**] [**Thermoset decorative panels**].
- I. Dust Panels: **1/4-inch (6.4-mm)** plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- 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 rabbeted joints supplemented by mechanical fasteners**] [**or**] [**glued dovetail joints**].
- 2.4 WOOD CABINETS FOR OPAQUE FINISH
- A. Grade: [**Premium**] [**Custom**] [**Economy**].

- B. [<Double click to insert sustainable design text for regional wood materials.>](#)
- C. [<Double click to insert sustainable design text for certified wood.>](#)
- D. Type of Construction: [**Frameless**] [**Face frame**].
- E. Cabinet and Door and Drawer Front Interface Style: [**Flush overlay**] [**Reveal overlay**] [**Lipped**] [**Flush inset**].
- F. Reveal Dimension: [**1/2 inch (13 mm)**] [**As indicated**] <Insert dimension>.
- G. Species for Exposed Lumber Surfaces: Any closed-grain hardwood.
- H. Panel Product for Exposed Surfaces: Medium-density [**fiberboard**] [**overlay**].
- I. Semiexposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other Than Drawer Bodies: [**Match materials indicated for exposed surfaces**] [**Thermoset decorative panels**].
 - a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - 2. Drawer Sides and Backs: [**Solid-hardwood lumber**] [**Thermoset decorative panels with PVC or polyester edge banding**].
 - 3. Drawer Bottoms: [**Hardwood plywood**] [**Thermoset decorative panels**].
- J. Dust Panels: **1/4-inch (6.4-mm)** plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with [**glued rabbeted joints supplemented by mechanical fasteners**] [**or**] [**glued dovetail joints**].

2.5 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. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (75 mm)** wide.
 - 2. Wood Moisture Content: [**5 to 10**] [**8 to 13**] [**4 to 9**] 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. [<Double click to insert sustainable design text for recycled content.>](#)

C. <Double click to insert sustainable design text for composite wood products.>

1. Medium-Density Fiberboard: ANSI A208.2, [**Grade 130**] <Insert grade>.
2. Particleboard: ANSI A208.1, [**Grade M-2**] [**Grade M-2-Exterior Glue**].
3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 - a. **Products:** Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) Environ Biocomposites Manufacturing LLC; Biofiber Wheat.
 - 2) Sorm Incorporated; Primeboard Premium Wheat.
 - 3) <Insert manufacturer's name; product name or designation>.
4. Softwood Plywood: DOC PS 1[, **medium-density overlay**].
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
6. Thermoset Decorative Panels: Particleboard or 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.

2.6 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, 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.
1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, 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. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.

4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
1. For panels **3/4 inch (19 mm)** thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, **1600 psi (11 MPa)**; modulus of elasticity, **300,000 psi (2070 MPa)**; internal bond, **80 psi (550 kPa)**; and screw-holding capacity on face and edge, **250 and 225 lbf (1100 and 1000 N)**, respectively.
 2. For panels **13/16 to 1-1/4 inches (20 to 32 mm)** thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, **1300 psi (9 MPa)**; modulus of elasticity, **250,000 psi (1720 MPa)**; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, **250 and 175 lbf (1100 and 780 N)**, respectively.
 3. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **Flakeboard Company Limited**; Duraflake FR.
 - b. **SierraPine**; Encore FR.
 - c. **<Insert manufacturer's name; product name or designation>**.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **Panel Source International, Inc.**; Pyroblock Platinum.
 - b. **SierraPine**; Medite FR.
- 2.7 CABINET HARDWARE AND ACCESSORIES
- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
 - B. Butt Hinges: **2-3/4-inch (70-mm)**, five-knuckle steel hinges made from **0.095-inch- (2.4-mm-)** thick metal, and as follows:

1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
 2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, [100] [135] [170] degrees of opening[, self-closing].
- D. Back-Mounted Pulls: BHMA A156.9, B02011.
- E. Wire Pulls: Back mounted, solid [metal] [plastic], [4 inches (100 mm) long, 5/16 inch (8 mm) in diameter] [5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter].
- F. Catches: [Magnetic catches, BHMA A156.9, B03141] [Push-in magnetic catches, BHMA A156.9, B03131] [Roller catches, BHMA A156.9, B03071] [Ball friction catches, BHMA A156.9, B03013].
- G. Adjustable Shelf Standards and Supports: [BHMA A156.9, B04071; with shelf rests, B04081] [BHMA A156.9, B04102; with shelf brackets, B04112].
- H. Shelf Rests: BHMA A156.9, B04013; [metal] [plastic] [metal, two-pin type with shelf hold-down clip].
- I. Drawer Slides: BHMA A156.9.
1. Grade 1 and Grade 2: Side mounted[and extending under bottom edge of drawer]; [full-extension] [partial-extension] type; [zinc-plated steel] [epoxy-coated steel] with polymer rollers.
 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; [full-extension] [full-overtravel-extension] type; zinc-plated-steel ball-bearing slides.
 3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide [Grade 2] [Grade 1].
 4. 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 1] [Grade 1HD-100].
 5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide [Grade 1HD-100] [Grade 1HD-200].
 6. For computer keyboard shelves, provide [Grade 1] [Grade 1HD-100].
 7. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide [Grade 1HD-100] [Grade 1HD-200].
- J. [Plastic] [Aluminum] Slides for Sliding Glass Doors: BHMA A156.9, B07063.
- K. Door Locks: BHMA A156.11, E07121.
- L. Drawer Locks: BHMA A156.11, E07041.
- M. Door and Drawer Silencers: BHMA A156.16, L03011.
- N. Float Glass for Cabinet Doors: ASTM C 1036, Type I, [Class 1 (clear)] [Class 2 or 3 (tinted)], Quality-Q3, [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] thick.
1. Tint Color: [Blue-green] [Bronze] [Green] [Gray] <Insert color>.

- O. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, [Class 1 (clear)] [Class 2 or 3 (tinted)], Quality-Q3[, with exposed edges seamed before tempering], 6 mm thick unless otherwise indicated.
1. Tint Color: [Blue-green] [Bronze] [Green] [Gray] <Insert color>.
- P. Mirror Glass for Cabinet Doors: ASTM C 1503, Mirror [Select] [Glazing], Quality-Q3, [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] thick.
- Q. Decorative Glass for Cabinet Doors: Provide decorative glass complying with Section 088113 "Decorative Glass Glazing."
- R. Tempered Float Glass for Cabinet Shelves: ASTM C 1048, Kind FT, Condition A, Type I, [Class 1 (clear)] [Class 2 or 3 (tinted)], Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.
1. Tint Color: [Blue-green] [Bronze] [Green] [Gray] <Insert color>.
- S. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match Architect's sample.
 2. Bright Brass, Clear Coated: BHMA 605 for brass base; BHMA 632 for steel base.
 3. Bright Brass, Vacuum Coated: BHMA 723 for brass base; BHMA 729 for zinc-coated-steel base.
 4. Satin Brass, Blackened, Bright Relieved, Clear Coated: BHMA 610 for brass base; BHMA 636 for steel base.
 5. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 6. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
 7. Satin Stainless Steel: BHMA 630.
- T. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.8 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: [Softwood or hardwood lumber] [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. [<Double click to insert sustainable design text for adhesives.>](#)

2.9 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets: **1/16 inch (1.5 mm)** unless otherwise indicated.
- C. Complete fabrication, including assembly[, **finishing,**] 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.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. 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.
- E. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.10 SHOP FINISHING

- A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. General: Shop finish transparent-finished architectural wood cabinets at fabrication shop as specified in this Section. Refer to Section 099123 "Interior Painting" for field finishing opaque-finished architectural woodwork.
- C. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to [**Section 099123 "Interior Painting"**] [**and**] [**Section 099300 "Staining and Transparent Finishing"**] for field finishing architectural woodwork not indicated to be shop finished.
- D. Shop Priming: Shop apply the prime coat including backpriming, if any, for[**transparent-finished**] items specified to be field finished. Refer to [**Section 099123 "Interior Painting"**] [**and**] [**Section 099300 "Staining and Transparent Finishing"**] for material and application requirements.

- E. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.
1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.
- F. Transparent Finish:
1. Grade: [**Premium**] [**Custom**] [**Economy**] [**Same as item to be finished**].
 2. Finish: System - 1, nitrocellulose lacquer.
 3. Finish: System - 2, precatylyzed lacquer.
 4. Finish: System - 3, postcatylyzed lacquer.
 5. Finish: System - 4, water-based latex acrylic.
 6. Finish: System - 5, conversion varnish.
 7. Finish: System - 6, synthetic penetrating oil.
 8. Finish: System - 7, catalyzed vinyl.
 9. Finish: System - 8, water-based cross linking acrylic.
 10. Finish: System - 9, UV curable acrylated epoxy, polyester, or urethane.
 11. Finish: System - 10, water-based UV curable.
 12. Finish: System - 11, catalyzed polyurethane.
 13. Finish: System - 12, water-based polyurethane.
 14. Finish: System - 13, catalyzed polyester.
 15. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
 16. Staining: [**None required**] [**Match approved sample for color**] [**Match Architect's sample**].
 17. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 18. Filled Finish for Open-Grain Woods: [**After staining, apply wash-coat sealer and allow to dry.**] Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
 19. Sheen: [**Flat, 15-30**] [**Satin, 31-45**] [**Semigloss, 46-60**] [**Gloss, 61-100**] gloss units measured on 60-degree gloss meter per ASTM D 523.
- G. Opaque Finish:
1. Grade: [**Premium**] [**Custom**] [**Economy**] [**Same as item to be finished**].
 2. Finish: System - 1, nitrocellulose lacquer.
 3. Finish: System - 2, precatylyzed lacquer.
 4. Finish: System - 3, postcatylyzed lacquer.
 5. Finish: System - 4, water-based latex acrylic.
 6. Finish: System - 5, conversion varnish.
 7. Finish: System - 7, catalyzed vinyl.
 8. Finish: System - 8, water-based cross linking acrylic.
 9. Finish: System - 9, UV curable acrylated epoxy, polyester, or urethane.
 10. Finish: System - 10, water-based UV curable.
 11. Finish: System - 11, catalyzed polyurethane.
 12. Finish: System - 12, water-based polyurethane.
 13. Finish: System - 13, catalyzed polyester.
 14. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

15. Sheen: [Flat, 15-30] [Satin, 31-45] [Semigloss, 46-60] [Gloss, 61-100] gloss units measured on 60-degree gloss meter per ASTM D 523.

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, including removal of packing and backpriming.

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[**or finishing screws**] for exposed fastening, countersunk and filled flush with woodwork.
 - 1. For shop finished items 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. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. 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**] [**No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish**] [**toggle bolts through metal backing or metal framing behind wall finish**].
- G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.
- H. Refer to [**Section 099123 "Interior Painting"**] [**and**] [**Section 099300 "Staining and Transparent Finishing"**] for final finishing of installed architectural woodwork[**not indicated to be shop finished**].

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. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064113

SECTION 07 1113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Cold-applied, cut-back-asphalt dampproofing.
- 2. Cold-applied, emulsified-asphalt dampproofing.

- B. Related Requirements:

- 1.
- 2. Section 042000 "Unit Masonry" for mortar parge coat on masonry surfaces.

1.3 ACTION SUBMITTALS

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

- B. Sustainable Design Submittals:

- 1. [<Double click to insert sustainable design text for coatings.>](#)

1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course, molded-sheet drainage panels, and auxiliary materials recommended in writing by manufacturer of primary materials.
- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.
- C. [<Double click to insert sustainable design text for low-emitting materials.>](#)

2.2 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.
- C. Brush and Spray Coats: ASTM D 4479, Type I, fibered or nonfibered.

2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Trowel Coats: ASTM D 1227, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.4 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D 41.
- C. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- D. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- E. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by dampproofing manufacturer.

- F. Protection Course: ASTM D 6506, **1/8-inch- (3-mm-)** thick, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
- G. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced on one side or both sides with plastic film, nominal thickness **1/4 inch (6 mm)**, with a compressive strength of not less than **8 psi (55 kPa)** per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272.
- H. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, **1/2 inch (13 mm)** thick.
- I. Protection Course: Smooth-surfaced roll roofing complying with ASTM D 6380, Class S, Type III.

2.5 MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Drainage Panel: Comply with Section 334600 "Subdrainage."
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding **No. 70 (0.21-mm)** sieve laminated to one side of the core; and with a vertical flow rate of **9 to 15 gpm per ft. (112 to 188 L/min. per m)**.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
 - 1. Test for surface moisture according to ASTM D 4263.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

- B. Clean substrates of projections and substances detrimental to the damproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for damproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply damproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where damproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of **6 inches (150 mm)** over outside face of footing.
 - 1. Extend damproofing **12 inches (300 mm)** onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an **8-inch- (200-mm-)** wide strip of asphalt-coated glass fabric in a heavy coat of damproofing. Damproofing coat for embedding fabric is in addition to other coats required.
- C. Where damproofing exterior face of inner wythe of exterior masonry cavity walls, lap damproofing at least **1/4 inch (6 mm)** onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend damproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap damproofing at least **1/4 inch (6 mm)** onto shelf angles supporting veneer.
- D. Where damproofing interior face of above-grade, exterior [**concrete**] [**and**] [**masonry**] [**single-wythe masonry**] walls, continue damproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by damproofing wall before constructing intersecting walls.

3.4 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Concrete Foundations[**and Parged Masonry Foundation Walls**]: Apply [**two brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat**] [**or**] [**one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m)**].

- B. Unparged Masonry Foundation Walls: Apply [primer and two brush or spray coats at not less than **1.25 gal./100 sq. ft. (0.5 L/sq. m)** for first coat and **1 gal./100 sq. ft. (0.4 L/sq. m)** for second coat] [or] [primer and one trowel coat at not less than **4 gal./100 sq. ft. (1.6 L/sq. m)**].

3.5 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations[and Parged Masonry Foundation Walls]: Apply [two brush or spray coats at not less than **1.5 gal./100 sq. ft. (0.6 L/sq. m)** for first coat and **1 gal./100 sq. ft. (0.4 L/sq. m)** for second coat] [one fibered brush or spray coat at not less than **3 gal./100 sq. ft. (1.2 L/sq. m)**] [or] [one trowel coat at not less than **4 gal./100 sq. ft. (1.6 L/sq. m)**].
- B. Unparged Masonry Foundation Walls: Apply [primer and two brush or spray coats at not less than **1.5 gal./100 sq. ft. (0.6 L/sq. m)** for first coat and **1 gal./100 sq. ft. (0.4 L/sq. m)** for second coat] [primer and one fibered brush or spray coat at not less than **3 gal./100 sq. ft. (1.2 L/sq. m)**] [or] [primer and one trowel coat at not less than **5 gal./100 sq. ft. (2 L/sq. m)**].

3.6 INSTALLATION OF PROTECTION COURSE

- A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 - 2. Install protection course on same day of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.7 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate dampproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. Install protection course before installing drainage panels.

3.8 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071113

SECTION 07 1900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:
 - 1. Concrete unit masonry.
- B. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's printed statement of VOC content.
 - 2. Include manufacturer's standard colors.
 - 3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
 - 4. Include printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies water repellents approved by MPI, with the proposed product highlighted.
- B. Samples: For each type and color of water repellent and substrate indicated, **12 by 12 inches (300 by 300 mm)** in size, with specified water-repellent treatment applied to half of each Sample.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Applicator .
- B. Product Certificates: For each type of water repellent.

- C. Preconstruction Test Reports: For water-repellent-treated substrates.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."
- C. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects, for preconstruction testing, and to set quality standards for materials and execution.
 - 1. Locate mockups in locations that enable viewing under same conditions as the completed Work .
 - a. Size: 10 sq. ft. (9.3 sq. m) each.
 - 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 PRECONSTRUCTION TESTING

- A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing of water repellents on field mockups .
 - 1. In addition to verifying performance requirements, use mockups to verify manufacturer's written instructions for application procedure and optimum rates of product application to substrates.
 - 2. Propose changes to materials and methods to suit Project.
 - 3. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.8 FIELD CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 - 1. Concrete surfaces and mortar have cured for not less than 28 days.
 - 2. Building has been closed in for not less than 30 days before treating wall assemblies.

3. Ambient temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C) and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C).
5. Rain or snow is not predicted within 24 hours.
6. Not less than 24 hours have passed since surfaces were last wet.
7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance: Water repellents shall meet the following performance requirements as determined by preconstruction testing on substrates representing those indicated for this Project.
- B. Water Absorption: Minimum [80] [90] <Insert number> percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:
 1. Concrete Masonry Units: ASTM C 140.
- C. Water-Vapor Transmission: Comply with one or both of the following:
 1. Maximum [10] <Insert number> percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E 96/E 96M.
 2. Minimum [80] <Insert number> percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D 1653.
- D. Water Penetration and Leakage through Masonry: Minimum [90] <Insert number> percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E 514/E 514M.
- E. Durability: Maximum [5] <Insert number> percent loss of water-repellent performance after 2500 hours of weathering according to ASTM G 154 compared to water-repellent-treated specimens before weathering.
- F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.
 1. Reduction of Water Absorption: [80] <Insert number> percent.
 2. Reduction in Chloride Content: [80] <Insert number> percent.

2.2 PENETRATING WATER REPELLENTS

- A. Silane, Penetrating Water Repellent: Clear, containing [20] <Insert number> percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Silane, Penetrating Water Repellent: Clear, containing [20] <Insert number> percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 600 g/L or less of VOCs.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- C. Siloxane, Penetrating Water Repellent: Clear, containing [10] <Insert number> percent or more solids of oligomeric alkylalkoxysiloxanes; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- D. Siloxane, Penetrating Water Repellent: Clear, containing [10] <Insert number> percent or more solids of oligomeric alkylalkoxysiloxanes; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with 600 g/L or less of VOCs.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- E. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- F. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 600 g/L or less of VOCs.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- G. Siliconate, Penetrating Water Repellent: Clear, methyl siliconate water repellent with 400 g/L or less of VOCs.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- H. Proprietary-Blend, Penetrating Water Repellent: Clear, consisting of one or several different resins (silanes or siloxanes), polymers, stearates, or oils plus other compounds or products of components; with 400 g/L or less of VOCs.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- I. Proprietary-Blend, Penetrating Water Repellent: Clear, consisting of one or several different resins (silanes or siloxanes), polymers, stearates, or oils plus other compounds or products of components; with 600 g/L or less of VOCs.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in six representative locations by method recommended by manufacturer.
 2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 3. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:
 1. Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E 1857 .
- C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Apply coating of water repellent on surfaces to be treated using roller or brush to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
- C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

- A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
 - 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect. .
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
 - 1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
 - 2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board.
 - 2. Molded polystyrene foam-plastic board.
 - 3. Glass-fiber blanket.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for recycled content.>](#)
 - 2. [<Double click to insert sustainable design text for adhesives.>](#)
 - 3. [<Double click to insert sustainable design text for insulation.>](#)

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
- B. Extruded Polystyrene Board, Type X: ASTM C 578, Type X, **15-psi (104-kPa)** minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
- C. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, **25-psi (173-kPa)** minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
- D. Extruded Polystyrene Board, Type IV, Drainage Panels: ASTM C 578, Type IV, **25-psi (173-kPa)** minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; fabricated with shi lap or channel edges and with one side having grooved drainage channels.
- E. Extruded Polystyrene Board, Type VI: ASTM C 578, Type VI, **40-psi (276-kPa)** minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - a. >.
- F. Extruded Polystyrene Board, Type VII Insert drawing designation: ASTM C 578, Type VII, **60-psi (414-kPa)** minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
- G. Extruded Polystyrene Board, Type VII, Drainage Panels Insert drawing designation: ASTM C 578, Type VII, **60-psi (414-kPa)** minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; fabricated with shi lap or channel edges and with one side having grooved drainage channels.

2.2 MOLDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Molded Polystyrene Board, Type I: ASTM C 578, Type I, **10-psi (69-kPa)** minimum compressive strength.
- B. Molded Polystyrene Board, Type VIII: ASTM C 578, Type VIII, **13-psi (90-kPa)** minimum compressive strength.

- C. Molded Polystyrene Board, Type II: ASTM C 578, Type II, **15-psi (104-kPa)** minimum compressive strength.
- D. Molded Polystyrene Board, Type IX: ASTM C 578, Type IX, **25-psi (173-kPa)** minimum compressive strength.
- E. Molded Polystyrene Board, Type XIV: ASTM C 578, Type XIV, **40-psi (276-kPa)** minimum compressive strength.
- F. Molded Polystyrene Board, Type XV: ASTM C 578, Type XV, **60-psi (414-kPa)** minimum compressive strength.

2.3 POLYISOCYANURATE FOAM-PLASTIC BOARD

- A. Polyisocyanurate Board, Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2.
- B. Polyisocyanurate Board, Glass-Fiber-Mat Faced: ASTM C 1289, glass-fiber-mat faced, Type II, Class 2.

2.4 GLASS-FIBER BLANKET

- A. [<Double click to insert sustainable design text for insulation.>](#)
- B. [<Double click to insert sustainable design text for recycled content.>](#)
- C. Glass-Fiber Blanket, Polypropylene-Scrim-Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
- D. Glass-Fiber Blanket, Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
- E. Glass-Fiber Blanket, Reinforced-Foil Faced: 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.

2.5 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
- 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.

- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of [1 inch (25 mm)] [2 inches (50 mm)] [3 inches (76 mm)] between face of insulation and substrate to which anchor is attached.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.6 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 - 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
 - 1. [<Double click to insert sustainable design text for VOC content of adhesive.>](#)
 - 2. [<Double click to insert sustainable design text for low emitting adhesives.>](#)
- C. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- 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. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of [24 inches (610 mm)] [36 inches (915 mm)] <Insert dimension> below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of [24 inches (610 mm)] [36 inches (915 mm)] <Insert dimension> in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."
- B. Cellular-Glass Board Insulation: Install with closely fitting joints using **[adhesive pad]** **[serrated trowel]** attachment method according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 1. Use insulation widths and lengths that fill the 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 a 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. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed **96 inches (2438 mm)**, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
 7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward **[exterior of construction]** **[interior of construction]** **[as indicated on Drawings]**.
 - b. Interior Walls: Set units with facing placed **[as indicated on Drawings]** **[toward areas of high humidity]** **<Insert location>**.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately **2.5 lb/cu. ft. (40 kg/cu. m)**.
 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- C. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation."

- D. **Spray-Applied Cellulosic Insulation:** Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
 2. Install insulation to fit snugly without bowing.

3.8 INSTALLATION OF REFLECTIVE INSULATION

- A. Install sheet reflective insulation according to ASTM C 727.
- B. Install sheet radiant barriers according to ASTM C 1744.
- C. Install interior radiation control coating system according to ASTM C 1321.

3.9 PROTECTION

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

END OF SECTION 072100

SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Closed-cell spray polyurethane foam.
 - 2. Open-cell spray polyurethane foam.
- B. Related Requirements:
 - 1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES .

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of [**1.5 lb/cu. ft. (24 kg/cu. m)**] <Insert density> and minimum aged R-value at **1-inch (25.4-mm)** thickness of **6.2 deg F x h x sq. ft./Btu at 75 deg F (43 K x sq. m/W at 24 deg C)**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: [**25**] [**75**] <Insert value> or less.
 - b. Smoke-Developed Index: [**450**] <Insert value> or less.
 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 OPEN-CELL SPRAY POLYURETHANE FOAM

- A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent. Minimum density of [**0.4 lb/cu. ft. (6.4 kg/cu. m)**] <Insert density> and minimum aged R-value at **1-inch (25.4-mm)** thickness of **3.4 deg F x h x sq. ft./Btu at 75 deg F (24 K x sq. m/W at 24 deg C)**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: [**25**] [**75**] <Insert value> or less.
 - b. Smoke-Developed Index: [**450**] <Insert value> or less.
 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Cavity Walls: Install into cavities to thickness indicated on Drawings .
- F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 07 2500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wrap.
 - 2. Flexible flashing.
 - 3. Drainage material.

1.3 ACTION SUBMITTALS

- A. 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.
- B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 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. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 - 2. Water-Vapor Permeance: Not less than [**75 perms (4300 ng/Pa x s x sq. m)**] [**20 perms (1150 ng/Pa x s x sq. m)**] [**8 perms (460 ng/Pa x s x sq. m)**] <Insert value> per ASTM E 96/E 96M, Desiccant Method (Procedure A).

3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg (0.02 L/s x sq. m at 75 Pa) when tested according to ASTM E 2178.
4. Allowable UV Exposure Time: Not less than three months.
5. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber 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)] [0.030 inch (0.8 mm)] [0.040 inch (1.0 mm)].

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, 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)] [0.030 inch (0.8 mm)] [0.040 inch (1.0 mm)].

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

C. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

D. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F 1667.

2.3 DRAINAGE MATERIAL

A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under [siding] [portland cement plaster] [adhered masonry veneer].

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- 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 a minimum **4-inch (100-mm)** overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. 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.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.3 DRAINAGE MATERIAL INSTALLATION

- A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500

SECTION 07 2600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Polyethylene vapor retarders.
2. Reinforced-polyethylene vapor retarders.
3. Fire-retardant, reinforced-polyethylene vapor retarders.

- B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.
2. Section 072100 "Thermal Insulation" for vapor retarders integral with insulation products.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 6-mil- (0.15-mm-) thick sheet, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

2.2 REINFORCED-POLYETHYLENE VAPOR RETARDERS

- A. Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and

weighing not less than [20 lb/1000 sq. ft. (9 kg/100 sq. m)] <Insert weight>, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

2.3 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on Drawings.
- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. 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.
- E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 INSTALLATION OF VAPOR RETARDERS IN CRAWL SPACES

- A. Install vapor retarders over prepared grade. Lap joints a minimum of 12 inches (305 mm) and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.

- B. Extend vapor retarder over footings and seal to foundation wall or grade beam with manufacturer's recommended tape.
 - 1. Extend vapor retarder vertically minimum [16 inches (406 mm)] [24 inches (610 mm)] <Insert dimension> above top of footing.
- C. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

3.4 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 07 5323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Mechanically fastened ethylene-propylene-diene-monomer (EPDM) roofing system.
- 2. Vapor retarder.
- 3. Roof insulation.

- B. Section includes the installation of insulation strips in ribs of roof deck. Insulation strips are furnished under Section 053100 "Steel Decking."

- C. Related Requirements:

- 1. Section 053100 "Steel Decking" for furnishing acoustical deck rib insulation.
- 2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
- 3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
- 4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, 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.

B. 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.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. [<Double click to insert sustainable design text for roofing.>](#)
2. [<Double click to insert sustainable design text for adhesives and sealants.>](#)

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.

3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacings and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

D. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 1. Submit evidence of complying with performance requirements.
- C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. 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.

- B. 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.
- C. 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.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 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.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special 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.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain components including roof insulation fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 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 a qualified testing agency to resist the following uplift pressures:
1. Corner Uplift Pressure: <Insert lbf/sq. ft. (kPa/sq. m)>.
 2. Perimeter Uplift Pressure: <Insert lbf/sq. ft. (kPa/sq. m)>.
 3. Field-of-Roof Uplift Pressure: <Insert lbf/sq. ft. (kPa/sq. m)>.
- D. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: [Class 1A-60] [Class 1A-75] [Class 1A-90] [Class 1A-105] [Class 1A-120] <Insert class>.
 2. Hail-Resistance Rating: [MH] [SH].
- E. <Double click to insert sustainable design text for solar reflectance index.>
- F. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for [low] [steep]-slope roof products.
- G. Energy Performance: Roofing system shall have an initial solar reflectance of not less than [0.70] <Insert value> and an emissivity of not less than [0.75] <Insert value> when tested according to CRRC-1.
- H. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, [Class A] [Class B] [Class C]; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- I. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 EPDM ROOFING

- A. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.
 - 1. >.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. [<Double click to insert sustainable design text for VOC content of adhesives and sealants.>](#)
 - 3. [<Double click to insert sustainable design text for low-emitting adhesives and sealants.>](#)
- B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
- C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55- to 60-mil- (1.4- to 1.5-mm-) thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
- D. Bonding Adhesive: Manufacturer's standard, water based.
- E. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- F. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- G. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- H. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.
- I. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- K. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

- L. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
- M. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
- N. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
 - 1. Provide white flashing accessories for white EPDM membrane roofing.

2.5 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate panel to roof deck.

2.6 VAPOR RETARDER

- A. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - 1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - 2. Adhesive: Manufacturer's standard lap adhesive, FM Global approved for vapor-retarder application.

2.7 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

2.8 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- 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 and cover boards 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.
 - 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - 3. Full-spread spray-applied, low-rise, two-component urethane adhesive.
- D. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, **1/2 inch (13 mm)** thick.
- E. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

2.9 ASPHALT MATERIALS

- A. Roofing Asphalt: ASTM D 312, Type III or Type IV.
- B. Asphalt Primer: ASTM D 41/D 41M.

2.10 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately **3/16 inch (5 mm)** thick and acceptable to roofing system manufacturer.

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."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- 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.
- C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.4 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
 - 2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 VAPOR-RETARDER INSTALLATION

- A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of **2 inches (50 mm)** and **6 inches (150 mm)**, respectively. Continuously seal side and end laps with tape.
- B. Laminate Sheet: Loosely lay laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of **2 inches (50 mm)** and **6 inches (150 mm)**, respectively. Continuously seal side and end laps with tape.
- C. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of **3-1/2 inches (90 mm)** and **6 inches (150 mm)**, respectively. Seal laps by rolling.

- D. Built-Up Vapor Retarder: Install two glass-fiber felt plies lapping each felt **19 inches (483 mm)** over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
- E. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is **2.7 inches (68 mm)** or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of **6 inches (150 mm)** in each direction.
 - 1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line 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.
- G. 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, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 3. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 4. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- H. 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 according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- I. 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 according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 3. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
 4. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 5. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- J. Loosely Laid Insulation: Loosely lay insulation units over substrate.
- K. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck.
1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.7 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhereroofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roofing.
- F. Fabric-Backed Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roofing.

- G. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.
- H. Apply roofing with side laps shingled with slope of roof deck where possible.
- I. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
 - 1. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- J. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
- K. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- L. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.
- M. Adhere protection sheet over membrane roofing at locations indicated.

3.8 MECHANICALLY FASTENED MEMBRANE ROOFING INSTALLATION

- A. Mechanically fasten roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
 - 1. For in-splice attachment, install roofing with long dimension perpendicular to steel roof deck flutes.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Mechanically fasten or adhere e roofing securely at terminations, penetrations, and perimeter of roofing.
- E. Apply roofing with side laps shingled with slope of roof deck where possible.
- F. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.

1. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
- H. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- I. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.
- J. In-Splice Attachment: Secure one edge of roofing using fastening plates or metal battens centered within splice, and mechanically fasten roofing to roof deck. Field splice seam.
- K. Through-Membrane Attachment: Secure roofing using fastening plates or metal battens, and mechanically fasten roofing to roof deck. Cover battens and fasteners with a continuous cover strip.
- L. Adhere protection sheet over membrane roofing at locations indicated.

3.9 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings[**and mechanically anchor to substrate through termination bars**].

3.10 COATING INSTALLATION

- A. Apply coatings to [**roofing**] [**and**] [**base flashings**] according to manufacturer's written recommendations, by spray, roller, or other suitable application method.

3.11 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
- B. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave **3 inches (75 mm)** of space between adjacent roof pavers.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage] [Engage]** a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - 1. Flood to an average depth of **2-1/2 inches (65 mm)** with a minimum depth of **1 inch (25 mm)** and not exceeding a depth of **4 inches (100 mm)**. Maintain **2 inches (50 mm)** of clearance from top of base flashing.
 - 2. Flood each area for **[24] [48] [72]** hours.
 - 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.13 PROTECTING AND CLEANING

- A. Protect membrane 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 membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.14 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: **<Insert name of Owner>**.
2. Address: **<Insert address>**.
3. Building Name/Type: **<Insert information>**.
4. Address: **<Insert address>**.
5. Area of Work: **<Insert information>**.
6. Acceptance Date: _____.
7. Warranty Period: **<Insert time>**.
8. Expiration Date: _____.

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

- D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/sec)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075323

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Manufactured through-wall flashing with counterflashing.
2. Manufactured reglets with counterflashing.
3. Formed roof-drainage sheet metal fabrications.
4. Formed low-slope roof sheet metal fabrications.
5. Formed steep-slope roof sheet metal fabrications.
6. Formed wall sheet metal fabrications.
7. Formed equipment support flashing.
8. Formed overhead-piping safety pans.

- B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 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.

1.4 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Sustainable Design Submittals:
 1. [<Double click to insert sustainable design text for recycled content.>](#)
- C. Shop Drawings: For sheet metal flashing and trim.
 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 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)] [3 inches per 12 inches (1:5)] <Insert scale>.
- D. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- E. 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.
 4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested .
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 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 and roof edge flashings that are SPRI ES-1 tested , shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge , including fascia , approximately **10 feet (3.0 m)** long, including supporting construction cleats, seams, attachments, underlayment, 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- 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: [20] [10] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: 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 remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. SPRI Wind Design Standard: Manufacture and install [copings] [roof edge flashings] tested according to SPRI ES-1 and capable of resisting the following design pressure:
1. Design Pressure: [As indicated on Drawings] <Insert design pressure>.
- E. [<Double click to insert sustainable design text for recycled content.>](#)
- 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.

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. 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. Two-Coat Fluoropolymer: AAMA 621. 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.
 - b. 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.
 - c. Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes 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.
 - d. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes 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.
 - e. FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - f. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 3. 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. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F (111 deg C); and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.
- C. Self-Adhering, High-Temperature Sheet: 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. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

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 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.
3. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. 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.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 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. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. 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.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- E. 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.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. 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.

- H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- I. 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.
- J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- K. Do not use graphite pencils to mark metal surfaces.

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. 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)**.
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet 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.
- D. Apply slip sheet, wrinkle free, [**over underlayment**] [**directly on substrate**] **<Insert requirement>** before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

- A. General: 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.
- B. 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**] [**and**] [**stainless-steel**] 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.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of [**10 feet (3 m)**] **<Insert dimension>** with no joints within **24 inches (600 mm)** of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate [**wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws**] [**substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance**] **<Insert size requirement>**.
- E. 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.
- F. 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."
- G. 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.

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 riveted and soldered joints. 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.
- C. Downspouts: Join sections with **1-1/2-inch (38-mm)** telescoping joints.
- D. 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.
- E. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of **1 inch (25 mm)** below scupper or gutter discharge.
- F. 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, sheet metal manufacturer's written installation instructions, 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. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered **3-inch (75-mm)** centers.
- C. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

- D. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at **[24-inch (600-mm)] [16-inch (400-mm)]** <Insert dimension> centers.
 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at **[24-inch (600-mm)]** <Insert dimension> centers.
- E. Copings: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.
- F. 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.
- G. 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 lead wedges and sealant] [interlocking folded seam or blind rivets and sealant] [anchor and washer at 36-inch (910-mm) centers]** <Insert requirement> unless otherwise indicated.
- H. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with **[elastomeric] [butyl]** 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.]" [Section 044200 "Exterior Stone Cladding.]" [Section <Insert Section number> "<Insert Section title>."]**
- C. Reglets: Installation of reglets is specified in **[Section 033000 "Cast-in-Place Concrete.]" [Section 042000 "Unit Masonry.]" [Section <Insert Section number> "<Insert Section title>."]**
- D. Opening Flashings in Frame Construction: Install continuous head, sill, **[jamb,]** and similar flashings to extend **[4 inches (100 mm)]** <Insert dimension> 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.
- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

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.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

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. Clean off excess solder.
- C. Clean off 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 076200

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Latex joint sealants.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Sustainable Design Submittals:
 - 1. Product Data for Sealant and Sealant Primers: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. 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.
- D. 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.
- E. 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.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- 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.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 - 3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with stone, brick, and other masonry substrates.
 - 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 - 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 - 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. 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 kind of sealant and joint substrate.
 - 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 X1.1 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.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer 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: 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 agrees to furnish joint sealants to repair or replace those joint sealants 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 stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from 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 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. Low-Emitting Interior Sealants: Sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. BASF Building Systems; Omniseal 50.
 - 2. Dow Corning Corporation; 795.
 - 3. Pecora Corporation; 864.
 - 4. Polymeric Systems, Inc.; PSI-641.
 - 5. Sika Corporation, Construction Products Division; SikaSil-C995.
 - 6. Tremco Incorporated; Spectrem 3.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. BASF Building Systems; Omniseal 50.
 - 2. Dow Corning Corporation; 795.
 - 3. Pecora Corporation; 864.

4. Polymeric Systems, Inc.; PSI-641.
5. Sika Corporation, Construction Products Division; SikaSil-C995.
6. Tremco Incorporated; Spectrem 3.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 1. BASF Building Systems; Omnplus.
 2. Dow Corning Corporation; 786 Mildew Resistant.
 3. GE Advanced Materials – Silicones; Sanitary SCS1700.
 4. May National Associates, Inc.; Bondaflex Sil 100 WF.
 5. Tremco Incorporated; Spectrem 3.

2.5 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and 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), 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.

2.6 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 performance of the Work.
- 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, 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. Unglazed surfaces of ceramic tile.
 - 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. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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.
- F. 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.
 - 4. Provide flush joint profile according to Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

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 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal work.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 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.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for recycled content.>](#)
- C. 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.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than **3 by 5 inches (75 by 127 mm)**.
 2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately **12 by 12 inches (305 by 305 mm)** to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
- F. 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. 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. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and 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.
- C. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level B according to SDI A250.4.
- D. 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.
- E. Hollow-Metal Doors and Frames: NAAMM-HMMA 860. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level A according to SDI A250.4.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level B according to SDI A250.4.
- C. 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.
- D. Hollow-Metal Doors and Frames: NAAMM-HMMA 860. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level A according to SDI A250.4.

2.5 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than **0.042 inch (1.0 mm)** thick, with corrugated or perforated straps not less than **2 inches (51 mm)** wide by **10 inches (254 mm)** long; or wire anchors not less than **0.177 inch (4.5 mm)** thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than **0.042 inch (1.0 mm)** thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum **3/8-inch (9.5-mm)** diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- 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. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at finish floor surface.

2.7 MATERIALS

- A. [<Double click to insert sustainable design text for recycled content.>](#)
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. 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.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. 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.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. 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.

2.8 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. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more

- than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 5. 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.
 6. 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.
 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- 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. 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.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. 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.

- c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than **6 inches (152 mm)** from top and bottom of frame. Space anchors not more than **26 inches (660 mm)** o.c.
- 5. Head Anchors: Two anchors per head for frames more than **42 inches (1067 mm)** wide and mounted in metal-stud partitions.
 - 6. 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.
 - 7. Terminated Stops: Terminate stops [**6 inches (152 mm)**] <Insert dimension> above finish floor with a [**45**] [**90**]-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- 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 templated 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 nontemplated, mortised, and surface-mounted door hardware.
 - 2. 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 butted or 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.

2.9 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.

- B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.10 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.
 - 2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
 - 3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than **0.016 inch (0.4 mm)** thick.

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. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. 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 nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. 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. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. 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. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
 - 8. 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.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
- 1. Non-Fire-Rated 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)**] [**5/8 inch (15.8 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)**.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

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. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

- B. Sustainable Design Submittals:

1. [<Double click to insert sustainable design text for regional materials.>](#)
2. [<Double click to insert sustainable design text for certified wood.>](#)
3. [<Double click to insert sustainable design text for certified wood.>](#)
4. [<Double click to insert sustainable design text for adhesives.>](#)
5. [<Double click to insert sustainable design text for composite wood.>](#)

- 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. Samples for Initial Selection: For factory-finished doors.
- E. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
 - 2. 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. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

- A. [<Double click to insert sustainable design text for manufacturer qualifications.>](#)
- B. [<Double click to insert sustainable design text for vendor qualifications.>](#)

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 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 ambient temperature and humidity conditions at occupancy levels during remainder of construction period.
- B. 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] [43 and 70] [17 and 50] <Insert numbers> percent during remainder of construction period.

1.9 WARRANTY

- A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than **1/4 inch (6.4 mm)** in a **42-by-84-inch (1067-by-2134-mm)** section.
 - b. Telegraphing of core construction in face veneers exceeding **0.01 inch in a 3-inch (0.25 mm in a 76.2-mm)** span.
 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 3. Warranty Period for Solid-Core Exterior Doors: Five years from date of Substantial Completion.
 4. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, **[provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
1. [ABS-American Building Supply- Doormerica.](#)
 2. [Algoma Hardwoods, Inc.](#)
 3. [Ampeco Products, LLC.](#)
 4. [Chappell Door Co.](#)
 5. [Eggers Industries.](#)
 6. [General Veneer Manufacturing Co.](#)
 7. [Graham Wood Doors; an Assa Abloy Group company.](#)
 8. [Haley Brothers, Inc.](#)
 9. [Ipik Door Company.](#)
 10. [Lambton Doors.](#)
 11. [Marlite.](#)
 12. [Marshfield Door Systems, Inc.](#)
 13. [Mohawk Flush Doors, Inc.](#)
 14. [Oregon Door.](#)
 15. [Oshkosh Door Company.](#)
 16. [Poncraft Door Company.](#)
 17. [Vancouver Door Company.](#)
 18. [VT Industries, Inc.](#)
 19. **<Insert manufacturer's name>.**
- 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's, AWMAC's, and WI's "Architectural Woodwork Standards."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. [<Double click to insert sustainable design text for regional materials.>](#)
- C. [<Double click to insert sustainable design text for certified wood.>](#)
- D. [<Double click to insert sustainable design text for adhesives.>](#)
- E. [<Double click to insert sustainable design text for composite wood products.>](#)

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Exterior Solid-Core Doors Insert drawing designation:
 - 1. Grade: Premium, with Grade AA faces.
- B. Interior Solid-Core Doors:
 - 1. Grade: Premium, with Grade AA faces.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. 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.
 - 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. 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.
- E. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory finishing.
1. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Factory finish doors that are indicated to receive transparent finish.
- D. Factory finish doors where indicated in schedules or on Drawings as factory finished.
- E. Transparent Finish:
1. Grade: Premium.

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. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide **1/8 inch (3.2 mm)** at heads, jambs, and between pairs of doors. Provide **1/8 inch (3.2 mm)** from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide **1/4 inch (6.4 mm)** from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - b. 2. Bevel non-fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock and hinge edges.
 - 2. Bevel fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

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 081416

SECTION 08 4113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Exterior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for ribbon walls.
4. Storefront framing for punched openings.
5. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Sustainable Design Submittals:

1. [<Double click to insert sustainable design text for sealants.>](#)

- C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. 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.
- 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. 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.
- G. 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.
- H. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Preconstruction Laboratory Mockup Testing Submittals:
 - 1. Testing Program: Developed specifically for Project.
 - 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 - 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.
- B. Qualification Data: For Installer.
- C. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Laboratory Mockup Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025..
- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- 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.
- E. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

1.8 MOCKUPS

- A. 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 wall area as shown on Drawings.
 - 2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION LABORATORY MOCKUPS

- A. Preconstruction Testing Service: **[Owner will engage]** **[Engage]** a qualified testing agency to perform testing on preconstruction laboratory mockups.
- B. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.
 1. Size and Configuration: As indicated on Drawings.
 2. Notify Architect **[seven]** **<Insert number>** days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.
- C. Preconstruction Laboratory Mockup Testing Program: Test preconstruction laboratory mockups according to requirements in "Performance Requirements" Article. Perform the following tests in the following order:
 1. Structural: ASTM E 330 at 50 percent of positive test load.
 2. Air Infiltration: ASTM E 283.
 3. Water Penetration under Static Pressure: ASTM E 331.
 4. Water Penetration under Dynamic Pressure: AAMA 501.1.
 5. Structural: ASTM E 330 at 100 percent of positive and negative test loads. Repeat the following:
 - a. Air Infiltration: ASTM E 283.
 - b. Water Penetration under Static Pressure: ASTM E 331.
 6. Interstory Drift: AAMA 501.4 at 100 percent of design displacement. Repeat the following:
 - a. Air Infiltration: ASTM E 283.
 - b. Water Penetration under Static Pressure: ASTM E 331.
 7. Vertical Interstory Movement: AAMA 501.7. Repeat the following:
 - a. Air Infiltration: ASTM E 283.
 - b. Water Penetration under Static Pressure: ASTM E 331.
 8. Thermal Cycling: According to AAMA 501.5. Repeat the following:
 - a. Air Infiltration: ASTM E 283.
 - b. Water Penetration under Static Pressure: ASTM E 331.
 9. Structural: ASTM E 330 at 100 and 150 percent of positive and negative test loads. Repeat the following:

- a. Air Infiltration: ASTM E 283.
- b. Water Penetration under Static Pressure: ASTM E 331.

1.10 WARRANTY

- A. Special Warranty: Manufacturer and Installer 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 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," 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: As indicated on Drawings.
 2. Other Design Loads: [As indicated on Drawings] <Insert loads>.
- 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] [1/175 of clear span for spans up to **13 feet 6 inches (4.1 m)** and to 1/240 of clear span plus **1/4 inch (6.35 mm)** for spans greater than **13 feet 6 inches (4.1 m)**] <Insert deflection limit> 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] [amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than **1/8 inch (3.2 mm)**].
 - a. Operable Units: Provide a 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: Test according to 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] <Insert number> 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] <Insert number> percent of span.
 3. Test Durations: As required by design wind velocity, but not less than [10] <Insert number> 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)**] <Insert value> at a static-air-pressure differential of [**1.57 lbf/sq. ft. (75 Pa)**] [**6.24 lbf/sq. ft. (300 Pa)**] <Insert value>.
2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of [**1.0 cfm/sq. ft. (5.08 L/s per sq. m)**] <Insert value> at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)**.
 - b. Single Doors: Maximum air leakage of [**0.5 cfm/sq. ft. (2.54 L/s per sq. m)**] <Insert value> 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 a 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)**] [**10 lbf/sq. ft. (480 Pa)**] [**15 lbf/sq. ft. (720 Pa)**] <Insert value>.
- 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)**] [**10 lbf/sq. ft. (480 Pa)**] [**15 lbf/sq. ft. (720 Pa)**] <Insert value>.
 2. Maximum Water Leakage: [**According to AAMA 501.1**] [**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. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
 1. Design Displacement: [**As indicated on Drawings**] <Insert design displacement>.
 2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement[**and 1.5 times the design displacement**].
- J. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <Insert requirement>.
 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement[**and 1.5 times the design displacement**].
 2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement[**and 1.5 times the design displacement**].
- K. Energy Performance: Certify and label energy performance according to NFRC as follows:
 1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than [**0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K)**] [**0.57 Btu/sq. ft. x h x**

- deg F (3.23 W/sq. m x K)] [0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K)] <Insert value>** as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than **[0.35] [0.40] [0.45] <Insert value>** as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than **[15] [25] [35] [45] <Insert value>** as determined according to NFRC 500.
- L. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.
1. Outdoor-Indoor Transmission Class: Minimum **[26] [30] [34] <Insert number>**.
- M. Blast Resistance:
1. Hazard Rating: **[No Break] [No Hazard] [Minimal Hazard] [Very Low Hazard] [Low Hazard] [High Hazard]** per ASTM F 1642.
 2. Performance Condition: **[1] [2] [3a] [3b] [4] [5]** per GSA-TS01.
- N. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for **[Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4]**.
1. Large-Missile Test: For glazed openings located within **30 feet (9.1 m)** of grade.
- O. 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. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of **[180 deg F (82 deg C)] <Insert temperature>**.
 - b. Low Exterior Ambient-Air Temperature: **[0 deg F (minus 18 deg C)] <Insert temperature>**.
 - c. Interior Ambient-Air Temperature: **[75 deg F (24 deg C)] <Insert temperature>**.
- P. Structural-Sealant Joints:
1. Designed to carry gravity loads of glazing.
 2. Designed to produce tensile or shear stress of less than **20 psi (138 kPa)**.
- Q. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront system without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, venting windows, 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: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Finish: Color anodic finish.
 4. 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 nonstaining, 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 VENTING WINDOWS

- A. Aluminum Windows: Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:
 - 1. Window Type: As indicated on Drawings.
- B. Glazing: Same as adjacent aluminum-framed entrances and storefront glazing.
- C. Finish: Match adjacent aluminum-framed entrances and storefront finish.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: **2-inch (50.8-mm)** overall thickness, with minimum **0.188-inch- (4.8-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: As indicated.
 - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
- C. 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.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
- E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- F. Manual Flush Bolts: BHMA A156.16, Grade 1.

- G. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- H. 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.
- I. Cylinders: As specified in Section 087100 "Door Hardware."
- J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- K. Operating Trim: BHMA A156.6.
- L. Removable Mullions: BHMA A156.3, extruded aluminum.
 - 1. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.
- M. 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.
- N. Concealed Overhead Holders: BHMA A156.8, Grade 1.
- O. Surface-Mounted Holders: BHMA A156.16, Grade 1.
- P. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- Q. 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.
- R. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- S. Silencers: BHMA A156.16, Grade 1.
- T. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of **1/2 inch (12.7 mm)**.
- U. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.7 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- 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.
 - 1. [<Double click to insert sustainable design text for sealants.>](#)
 - 2. [<Double click to insert sustainable design text for sealants.>](#)

2.8 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.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- 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.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials or Dead-soft, **0.018-inch- (0.457-mm-)** thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.
- 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.

2.9 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. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using shear-block system.
- G. 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.
 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. 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.
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- 2.10 ALUMINUM FINISHES
- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
1. Color: As selected by Architect from full range of industry colors and color densities.
- 2.11 SOURCE QUALITY CONTROL
- A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

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 the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. 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.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 088000 "Glazing."
- G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 2. 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.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage] [Engage]** a 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] [mockups] <Insert requirements>.**
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 a minimum of **[two] [three] <Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion] <Insert requirements>.**
- C. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
1. Test a minimum of **[two] [four] [six] <Insert number>** areas on each building facade.
 2. Repair installation areas damaged by testing.

- D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

- A. Entrance Door Hardware:
 - 1. 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 entrance door hardware.
 - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide [six] <Insert number> 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.

3.7 ENTRANCE DOOR HARDWARE SETS

END OF SECTION 084113

SECTION 08 7100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.
 - 3. Electrified door hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
 - 1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and building safety and security systems.
 - b. Schematic diagram of systems that interface with electrified door hardware.
 - c. Point-to-point wiring.
 - d. Risers.
 - e. Elevations doors controlled by electrified door hardware.
 - 2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.
- D. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.

1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.
 - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

E. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. 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.
 - c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - d. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - 5) Fastenings and other pertinent information.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) List of related door devices specified in other Sections for each door and frame.
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 that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
 - D. Warranty: Special warranty specified in this Section.
- 1.5 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- 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.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
 1. For door hardware, an Architectural Hardware Consultant (AHC) who is also an Electrified Hardware Consultant (EHC).
 - C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
 - D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a

qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

- E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
- F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- H. Accessibility Requirements: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1 for door hardware on doors in an accessible route.
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 (22.2 N).
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated 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.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Closers: Adjust door and gate closer sweep periods so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.
 4. Spring Hinges: Adjust door and gate spring hinges so that, from an open position of 70 degrees, the time required to move the door to the closed position is 1.5 seconds minimum.
- I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Requirements for access control.
 5. Address for delivery of keys.

- J. 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. Inspect and discuss preparatory work performed by other trades.
 - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 - 4. Review sequence of operation for each type of electrified door hardware.
 - 5. Review required testing, inspecting, and certifying procedures.

1.8 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 coordinated with the final door hardware schedule, and include 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.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.9 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.10 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 doors 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, unless otherwise indicated.

1.11 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide [six] <Insert number> 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 and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled on Drawings to comply with requirements in this Section.
 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 Schedule" 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 Schedule" Article.
 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1.

2.3 SELF-CLOSING HINGES AND PIVOTS

- A. Self-Closing Hinges and Pivots: BHMA A156.17.

2.4 CENTER-HUNG AND OFFSET PIVOTS

- A. Center-Hung and Offset Pivots: BHMA A156.4.

2.5 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Pin-and-Barrel-Type Hinges:
- C. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.6 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.
- D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
- E. Mortise Locks: BHMA A156.13; [Operational] [Security] Grade [1] [2]; stamped steel case with steel or brass parts; Series 1000.
- F. Roller Latches: BHMA A156.16; Grade 1; rolling plunger that engages socket or catch, with adjustable roller projection.
- G. Push-Pull Latches: [Bored, BHMA A156.2; Series 4000] [Mortise, BHMA A156.13]; Grade [1] [2]; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.

2.7 AUXILIARY LOCKS

- A. Mortise Auxiliary Locks: BHMA A156.5; Grade [1] [2]; with strike that suits frame.
- B. Push-Button Combination Locks: BHMA A156.5; mortise; Grade 2; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.

2.8 EXIT LOCKS AND EXIT ALARMS

- A. Exit Locks and Alarms: BHMA A156.29, Grade 1.

2.9 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

2.10 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Manufacturer: Same manufacturer as for locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade [1] [1A] [2]; permanent cores that are [interchangeable] [removable]; face finished to match lockset.
- C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.11 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - 1. No Master Key System: Only change keys operate cylinder.
 - 2. Master Key System: Change keys and a master key operate cylinders.
 - 3. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
 - 4. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
 - 5. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - b. Re-key Owner's existing master key system into new keying system.

6. Keyed Alike: Key all cylinders to same change key.

B. Keys: **[Nickel silver]** **[Brass]**.

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: Three.

b. Master Keys: Five.

c. Grand Master Keys: Five.

d. Great-Grand Master Keys: Five.

2.12 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; 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]** **<Insert number>** percent of the number of locks.

1. Multiple-Drawer Cabinet: Cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.

2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

3. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

B. Key Lock Boxes: Designed for storage of **[two]** **[10]** **<Insert number>** keys, **with tamper switches to connect to intrusion detection system**].

C. Cross-Index System: **[Multiple]** **[Single]**-index system for recording key information. Include three receipt forms for each key-holding hook. Set up by **[key control manufacturer]** **[Installer]**.

D. Key Control System Software: BHMA A156.5, Grade 1; multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

2.13 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

2.14 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

2.15 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.16 CONCEALED CLOSERS

- A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.17 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

2.18 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.

2.19 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed **0.50 cfm per foot** (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

2.20 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.21 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from **0.050-inch- (1.3-mm-)** thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.22 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.

2.23 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

- 1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal indicated, 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.

- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with 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. Fire-Rated Applications:

- a. Wood or Machine Screws: For the following:

- 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.

- b. Steel Through Bolts: For the following unless door blocking is provided:

- 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) 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."
 5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.24 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- 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-rated 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 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- 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. 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.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every **30 inches (750 mm)** of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every **30 inches (750 mm)** of door height greater than **90 inches (2286 mm)**.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as directed by Owner.
 2. Furnish permanent cores to Owner for installation.
- F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 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. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 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.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

END OF SECTION 087100

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Glass for windows, doors, and storefront framing.
 - 2. Glazing sealants and accessories.

1.3 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. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

- A. 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.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for sealants.>](#)
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; **12 inches (300 mm)** square.
- D. Glazing Accessory Samples: For sealants and colored spacers, in **12-inch (300-mm)** lengths. [**Install sealant Samples between two strips of material representative in color of the adjoining framing system.**]
- E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- F. 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.8 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. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than **[eight]** <Insert number> Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD 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 are below **40 deg F (4.4 deg C)**.

1.12 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: 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] <Insert number> years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for 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 separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: [Five] [10] <Insert number> years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for 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] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain tinted glass from single source from single manufacturer.
 2. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 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. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
- D. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with enhanced-protection testing requirements in ASTM E 1996 for Wind Zone 2 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.
 - 1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
 - 2. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.
- E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Ultraclear Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and solar heat gain coefficient of not less than 0.87.
- C. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- D. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- E. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- F. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
- G. Ceramic-Coated Vision Glass: ASTM C 1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in GANA's "Engineering Standards Manual."

2.5 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.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they 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. [<Double click to insert sustainable design text for sealants.>](#)
 - 4. [<Double click to insert sustainable design text for sealants.>](#)

5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- D. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- E. Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. 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, with 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 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.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
- 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.

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 offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 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 leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. 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.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. 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.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. 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.
- G. 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.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. 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.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. 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.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces 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.

3.8 MONOLITHIC GLASS SCHEDULE

END OF SECTION 088000

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.
 - 3. Grid suspension systems for gypsum board ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."
- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for recycled content.>](#)

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For embossed steel studs and runners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

- B. 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.
- C. Horizontal Deflection: For wall assemblies, limited to [1/240] [1/360] of the wall height based on horizontal loading of [5 lbf/sq. ft. (239 Pa)] [10 lbf/sq. ft. (480 Pa)].

2.2 FRAMING SYSTEMS

- A. [<Double click to insert sustainable design text for recycled content.>](#)
- B. 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)] [ASTM A 653/A 653M, G60 (Z180)] [Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120)], hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
 - 1. Steel Studs and Runners:
 - 2. Embossed Steel Studs and Runners:
- D. Slip-Type Head Joints: Where indicated, provide[**one of**] the following:
 - 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing [1-1/2-inch (38-mm)] [2-inch (51-mm)] [2-1/2-inch (64-mm)] [3-inch (76-mm)] <Insert dimension> minimum vertical movement.
 - 2. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 - 3. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - 4. 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.
- E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

- G. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
- I. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
- J. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
- K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.0179 inch (0.455 mm), and depth required to fit insulation thickness indicated.

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. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Flat Hangers: Steel sheet, in size indicated on Drawings.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
- F. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
 - 2. Steel Studs and Runners: ASTM C 645.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
 - 4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.

- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

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/D 226M, 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 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than **24 inches (610 mm)** o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-

resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- 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.

3.4 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.
- 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 that penetrate partitions above ceiling.
 - 1. 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.
 - 2. 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 at each jamb unless otherwise indicated.

- b. Install cripple studs at head adjacent to each jamb stud, with a minimum **1/2-inch (13-mm)** clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. 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.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. 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.
- E. Direct Furring:
 1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced **24 inches (610 mm)** o.c.
- F. Z-Shaped Furring Members:
 1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced [**24 inches (610 mm)**] **<Insert dimension>** o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced **24 inches (610 mm)** o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than **12 inches (305 mm)** from corner and cut insulation to fit.
- G. 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.

3.5 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.
- 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. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. 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.
- G. Installation Tolerances: Install suspension systems that are level to within [**1/8 inch in 12 feet (3 mm in 3.6 m)**] <Insert dimensions> measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Interior gypsum board.
- 2. Exterior gypsum board for ceilings and soffits.
- 3. Tile backing panels.
- 4. Texture finishes.

- B. Related Requirements:

- 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
- 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
- 3. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

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

- B. Sustainable Design Submittals:

- 1. [<Double click to insert sustainable design text for recycled content.>](#)
- 2. [<Double click to insert sustainable design text for regional materials.>](#)
- 3. [<Double click to insert sustainable design text for adhesives and sealants.>](#)
- 4. [<Double click to insert sustainable design text for low-emitting ceilings and walls.>](#)

- C. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in **12-inch-** (300-mm-) long length for each trim accessory indicated.
- 2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

- D. Samples for Initial Selection: For each type of trim accessory and textured finish indicated.

- E. Samples for Verification: For the following products:
1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
 2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
1. Build mockups for the following:
 - a. Each level of gypsum board finish 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. Store materials inside under cover and keep them dry and protected against weather, 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 instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. 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.
- C. [<Double click to insert sustainable design text for low-emitting ceilings and walls.>](#)

2.2 GYPSUM BOARD, GENERAL

- A. [<Double click to insert sustainable design text for recycled content.>](#)
- B. [<Double click to insert sustainable design text for regional materials.>](#)
- C. 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. Gypsum Wallboard: ASTM C 1396/C 1396M.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
- C. 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.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
- E. Foil-Backed Gypsum Board: ASTM C 1396/C 1396M.
- F. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M.
- G. Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M.
- H. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.

- B. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
- C. Acoustically Enhanced Gypsum Board: ASTM C 1396/C 1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.
- D. Skim-Coated Gypsum Board: ASTM C 1396/C 1396M. Manufactured with a factory-applied skim coat.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 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.
- D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. [<Double click to insert sustainable design text for VOC content of adhesive.>](#)
 2. [<Double click to insert sustainable design text for adhesives.>](#)
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 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. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 2. [<Double click to insert sustainable design text for recycled content.>](#)
- E. Acoustical 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. [<Double click to insert sustainable design text for sealants.>](#)
 2. [<Double click to insert sustainable design text for sealants.>](#)
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

2.9 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.

- B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E 84.
- C. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
- D. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.
- E. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. 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.
- C. 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.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft. (0.7 sq. m)** in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow **1/4- to 3/8-inch- (6.4- to 9.5-mm-)** wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. 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.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, 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, apply gypsum panels [**vertically (parallel to framing)**] [**horizontally (perpendicular to framing)**] unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, **16 inches (400 mm)** minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers [**and face layers separately to supports with screws**] [**with screws; fasten face layers with adhesive and supplementary fasteners**].

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions 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-inch- (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.

3.4 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at [**showers, tubs, and where indicated**] [**locations indicated to receive tile**]. Install with **1/4-inch (6.4-mm)** gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at [**showers, tubs, and where indicated**] [**locations indicated to receive tile**].
- C. Water-Resistant Backing Board: Install where indicated with **1/4-inch (6.4-mm)** gap where panels abut other construction or penetrations.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints **[at locations indicated on Drawings]** **[according to ASTM C 840 and in specific locations approved by Architect for visual effect]**.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners **[unless otherwise indicated]**.
 - 2. Bullnose Bead: Use **[at outside corners]** **[where indicated]** **<Insert requirements>**.
 - 3. LC-Bead: Use **[at exposed panel edges]** **<Insert requirements>**.
 - 4. L-Bead: Use **[where indicated]** **<Insert requirements>**.
 - 5. U-Bead: Use **[at exposed panel edges]** **[where indicated]** **<Insert requirements>**.
 - 6. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use **[at exposed panel edges]** **<Insert requirements>**.
- E. Aluminum Trim: Install in locations **[indicated on Drawings]** **<Insert requirements>**.

3.6 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, and where indicated.
 - 2. Level 2: **[Panels that are substrate for tile]** **[Panels that are substrate for acoustical tile]** **[Where indicated on Drawings]** **<Insert locations>**.
 - 3. Level 3: **[Where indicated on Drawings]** **<Insert locations>**.
 - 4. Level 4: **[At panel surfaces that will be exposed to view unless otherwise indicated]** **<Insert locations>**.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 - 5. Level 5: **[Where indicated on Drawings]** **<Insert locations>**.

- a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture[**matching approved mockup and**] free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.8 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, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 09 3013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Quarry tile.
2. Porcelain tile.
3. Glazed wall tile.
4. Stone thresholds.
5. Tile backing panels.
6. Waterproof membrane for thinset applications.
7. Crack isolation membrane.
8. Metal edge strips.

- B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 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. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for adhesives.>](#)
 - 2. [<Double click to insert sustainable design text for low-emitting sealers.>](#)
- 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 Initial Selection: For tile, grout, and accessories involving color selection.
- E. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least **36 inches (900 mm)** square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
 - 4. Stone thresholds in **6-inch (150-mm)** lengths.
 - 5. Metal edge strips in **6-inch (150-mm)** lengths.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 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.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single 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.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Stone thresholds.
 - 2. Waterproof membrane.
 - 3. Crack isolation membrane.
 - 4. Cementitious backer units.
 - 5. Metal edge strips.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise 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.
 - 1. Where tile is indicated for installation on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type

of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

- A. Ceramic Tile Type: Unglazed square-edged quarry tile.
- B. Ceramic Tile Type: Glazed porcelain tile.
- C. Ceramic Tile Type: Glazed wall tile.
- D. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as used for adjoining wall tile where noted.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to **1/16 inch (1.5 mm)** above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to **1/2 inch (12.7 mm)** or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 12 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
- C. Slate Thresholds: ASTM C 629/C 629M, Classification I Exterior and II Interior, with fine, even grain and honed finish.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A, in maximum lengths available to minimize end-to-end butt joints.

2.6 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product[, **selected from the following,**] that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.
- C. PVC Sheet: PVC heat-fused on both sides to facings of nonwoven polyester.
- D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; **0.008-inch (0.2-mm)** nominal thickness.

- E. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with fabric reinforcement facing; **0.040-inch (1 -mm)** nominal thickness.
- F. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
- G. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
- H. Latex-Portland Cement Waterproof Mortar: Flexible, waterproof mortar consisting of cement-based mix and latex additive.
- I. Waterproofing and Tile-Setting Adhesive: One-part, fluid-applied product intended for use as both waterproofing and tile-setting adhesive in a two-step process.
 - 1. [<Double click to insert sustainable design text for VOC content of adhesive.>](#)
 - 2. [<Double click to insert sustainable design text for adhesives.>](#)

2.7 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; **0.030-inch (0.76-mm)** nominal thickness.
- C. PVC Sheet: PVC heat-fused on both sides to facings of nonwoven polyester; **0.040-inch (1-mm)** nominal thickness.
- D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; **0.008-inch (0.2-mm)** nominal thickness.
- E. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; **3/16-inch (4-mm)** nominal thickness.
- F. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; **0.040-inch (1-mm)** nominal thickness.
- G. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
- H. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
- I. Latex-Portland Cement Crack-Resistant Mortar: Flexible mortar consisting of cement-based mix and latex additive.
- J. Crack Isolation Membrane and Tile-Setting Adhesive: One-part, fluid-applied product intended for use as both a crack isolation membrane and tile-setting adhesive in a two-step process.
 - 1. [<Double click to insert sustainable design text for VOC content of adhesive.>](#)

2. [<Double click to insert sustainable design text for adhesives.>](#)

2.8 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
- B. Dry-Set Portland Cement Mortar (Thinset): ANSI A118.1.
 1. A118.1.
- C. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.
- D. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.

2.9 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.
- C. High-Performance Tile Grout: ANSI A118.7.
- D. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.
- E. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.10 MISCELLANEOUS 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.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
- C. Metal Edge Strips: Angle or L-shaped, 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.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. [<Double click to insert sustainable design text for floor treatment products.>](#)

2.11 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 the Work.
 - 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. 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.

- C. 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.

3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone 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. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile swimming pool decks.
 - d. Tile floors in laundries.
 - e. Tile floors consisting of tiles **8 by 8 inches (200 by 200 mm)** or larger.
 - f. Tile floors consisting of rib-backed tiles.
- B. 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.
- C. 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.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. 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.

- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Quarry Tile: **3/8 inch (9.5 mm)**.
 2. Glazed Wall Tile: **1/16 inch (1.6 mm)**.
 3. Porcelain Tile: **1/4 inch (6.4 mm)**.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. 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.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
- K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- L. Floor Sealer: Apply floor sealer to [**cementitious**] grout joints [**in tile floors**] according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install panels 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 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 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 that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. 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 no 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.

3.8 PROTECTION

- A. 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.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

END OF SECTION 093013

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Related Requirements:
 - 1. Section 095123 "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with concealed suspension systems, stapling, or adhesive bonding.
 - 2. Section 095133 "Acoustical Metal Pan Ceilings."
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** <Insert location>.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for recycled content.>](#)
 - 2. [<Double click to insert sustainable design text for sealants.>](#)
 - 3. [<Double click to insert sustainable design text for ceilings.>](#)
- C. Samples: For each exposed product and for each color and texture specified, **6 inches (150 mm)** in size.
- D. Samples for Initial Selection: For components with factory-applied color finishes.
- E. 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 full-size and **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.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Suspended ceiling components.
 2. Structural members to which suspension systems will be attached.
 3. Size and location of initial access modules for acoustical panels.
 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 5. Perimeter moldings.
- B. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 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.
 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 3. Hold-Down Clips: Equal to 2 percent of quantity installed.
 4. Impact Clips: Equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical ceiling area as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 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.

1.10 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.
- C. [<Double click to insert sustainable design text for ceilings.>](#)

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.

2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. [<Double click to insert sustainable design text for recycled content.>](#)
- 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.
 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
 2. Pattern: CE (perforated, small holes and lightly textured).
- C. Color: As selected from manufacturer's full range.
- D. LR: Not less than **[0.65] [0.70] [0.75] [0.80] [0.85] [0.90] <Insert LR>**.
- E. NRC: Not less than **[0.10] [0.35] [0.40] [0.50] [0.55] [0.60] [0.65] [0.70] [0.75] [0.80] [0.85] [0.90] [0.95] [1.00] <Insert NRC>**.
- F. CAC: Not less than **[20] [25] [30] [35] [40] <Insert CAC>**.
- G. AC: Not less than **[170] [180] [190] [200] [210] <Insert AC>**.
- H. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension-system members.
- I. Thickness: **3/4 inch (19 mm)**.

- J. Modular Size: 24 by 24 inches (610 by 610 mm).
- K. 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 METAL SUSPENSION SYSTEMS, GENERAL

- A. [<Double click to insert sustainable design text for recycled content.>](#)
- B. 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.
 - 1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- C. 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. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Postinstalled expansion or postinstalled bonded anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - 2. 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.
- D. 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. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
- E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than **7/8 inch (22 mm)** wide; formed with **0.04-inch- (1-mm-)** thick, galvanized-steel sheet complying with ASTM A 653/A 653M, **G90 (Z275)** coating designation; with bolted connections and **5/16-inch- (8-mm-)** diameter bolts.
- G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.
- J. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced **24 inches (610 mm)** o.c. on all cross tees.
- K. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL SUSPENSION SYSTEM

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or 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. Structural Classification: [**Intermediate**] [**Heavy**]-duty system.
 2. End Condition of Cross Runners: [**Override (stepped)**] [**or**] [**butt-edge**] type.
 3. Face Design: Flat, flush.
 4. Cap Material: [**Steel**] [**or**] [**aluminum**] cold-rolled sheet.
 5. Cap Finish: [**Painted white**] [**Painted in color as selected from manufacturer's full range**] [**Painted to match color indicated by manufacturer's designation**] [**Painted to match color of acoustical unit**] [**Plated with metallic finish as selected from manufacturer's full range**] [**Plated with metallic finish indicated by manufacturer's designation**] [**Natural finish for aluminum**].
- C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than **G30 (Z90)** coating designation; with prefinished **9/16-inch- (15-mm-)** wide metal caps on flanges.
1. Structural Classification: [**Intermediate**] [**Heavy**]-duty system.
 2. End Condition of Cross Runners: [**Override (stepped)**] [**or**] [**butt-edge**] type.

3. Face Design: [Flat, flush] [Flanges formed with an integral center reveal].
4. Cap Material: [Steel] [or] [aluminum] cold-rolled sheet.
5. Cap Finish: [Painted white] [Painted in color as selected from manufacturer's full range] [Painted to match color indicated by manufacturer's designation] [Painted to match color of acoustical unit] [Plated with metallic finish as selected from manufacturer's full range] [Plated with metallic finish indicated by manufacturer's designation] [Natural finish for aluminum].

2.6 METAL EDGE MOLDINGS AND TRIM

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- 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.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with **ASTM B 221 (ASTM B 221M)** for Alloy and Temper 6063-T5.
 2. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
 3. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints:
 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Acoustical Sealant for Concealed Joints:
 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- C. 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.
 - 3. [<Double click to insert sustainable design text for sealants.>](#)
 - 4. [<Double click to insert sustainable design text for sealants.>](#)

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 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. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. 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.
 7. 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.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. 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.
 11. 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 into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:

- a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to **[long]** **[short]** axis of space.
 - c. Install panels in a basket-weave pattern.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. 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.
 5. 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.
 6. Install **[hold-down]** **[impact]** 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.
 7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
 8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: **[Owner will engage]** **[Engage]** a qualified special inspector to perform the following special inspections:
 1. Compliance of seismic design.
- B. Testing Agency: **[Owner will engage]** **[Engage]** a qualified testing agency to perform tests and inspections and prepare test reports.
- C. 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.

- D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. 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.

END OF SECTION 095113

SECTION 09 6813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes modular carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
 - 2. Section 096816 "Sheet Carpeting" for carpet roll goods.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.4 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 manufacturer's written installation recommendations for each type of substrate.
- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for adhesives.>](#)
 - 2. [<Double click to insert sustainable design text for carpeting products.>](#)
 - 3. [<Double click to insert sustainable design text for flooring.>](#)
- C. Shop Drawings: For carpet tile installation, plans showing 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. Pile direction.
 8. Type, color, and location of insets and borders.
 9. Type, color, and location of edge, transition, and other accessory strips.
 10. Transition details to other flooring materials.
- D. 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.
- E. Samples for Initial Selection: For each type of carpet tile.
1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
- F. Samples for Verification: 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.
- G. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- H. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
 - C. Sample Warranty: For special warranty.
- 1.6 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.

1.7 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)**.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Build mockups at locations and in sizes shown on Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

1.10 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" 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 levels planned for building occupants 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.

1.11 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, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Color: As selected by Architect from manufacturer's full range.
- C. Pattern: As selected by Architect from manufacturer's full range.
- D. Fiber Content: 100 percent nylon 6, 6.
- E. Pile Characteristic: Cut-and-loop pile.
- F. Primary Backing/Backcoating: PVC.
- G. Size: Modular **18 by 18 inches** (457 by 457 mm).
- H. Applied Treatments:
 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
 - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
- I. Sustainable Design Requirements:
 1. Sustainable Product Certification: Gold level certification according to ANSI/NSF 140.

2. [<Double click to insert sustainable design text for carpet and cushion.>](#)

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 comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
 1. [<Double click to insert sustainable design text for VOC content of adhesive.>](#)
 2. [<Double click to insert sustainable design text for adhesives.>](#)
- C. Metal Edge/Transition Strips: Extruded aluminum with [mill] **<Insert finish>** finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 1. Moisture Testing: Perform tests so that each test area does not exceed **200 sq. ft. (18.6 sq. m)**, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
- D. Wood Subfloors: Verify the following:
 1. Underlayment over subfloor complies with requirements specified in Section 061600 "Sheathing."
 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Metal Subfloors: Verify the following:
 1. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

- F. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer.
 - 1. Access Flooring Systems: Verify the following:
 - 2. Access floor substrate is compatible with carpet tile and adhesive if any.
 - 3. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than **1/8 inch (3 mm)**, protrusions more than **1/32 inch (0.8 mm)**, and substances that may interfere with adhesive bond or show through surface.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- 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. Concrete Substrates: 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 adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" 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. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. 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.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.
- I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive 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's "Carpet Installation Standard," Section 20, "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 096813

SECTION 09 6816 - SHEET CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Tufted carpet.
- 2. Woven carpet.
- 3. Carpet cushion.

- B. Related Requirements:

- 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.
- 2. Section 096813 "Tile Carpeting" for modular carpet tiles.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review methods and procedures related to carpet installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

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

- 1. Include manufacturer's written data on physical characteristics and durability.
- 2. Include manufacturer's written installation recommendations for each type of substrate.

- B. Sustainable Design Submittals:

- 1. [<Double click to insert sustainable design text for adhesives.>](#)
- 2. [<Double click to insert sustainable design text for carpeting products.>](#)

3. [<Double click to insert sustainable design text for flooring.>](#)
- C. Shop Drawings: For carpet installation, showing the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 2. Carpet type, color, and dye lot.
 3. Locations where dye lot changes occur.
 4. Seam locations, types, and methods.
 5. Type of subfloor.
 6. Type of installation.
 7. Pattern type, repeat size, location, direction, and starting point.
 8. Pile direction.
 9. Types, colors, and locations of insets and borders.
 10. Types, colors, and locations of edge, transition, and other accessory strips.
 11. Transition details to other flooring materials.
 12. Type of carpet cushion.
- D. 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: 12-inch- (300-mm-) square Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
 3. Carpet Cushion: 6-inch- (150-mm-) square Sample.
 4. Carpet Seam: 6-inch (150-mm) Sample.
 5. Mitered Carpet-Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.
- E. Samples for Initial Selection: For each type of product.
1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
- F. Samples for Verification: 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: 12-inch- (300-mm-) square Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
 3. Carpet Cushion: 6-inch- (150-mm-) square Sample.
 4. Carpet Seam: 6-inch (150-mm) Sample.
 5. Mitered Carpet-Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.
- G. Product Schedule: For carpet. Use same designations indicated on Drawings.
- H. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, 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.

1.7 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: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups at locations and in sizes shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."
- B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.10 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.11 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
 - b. Loss of tuft bind strength.
 - c. Excess static discharge.
 - d. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Warranty for Carpet Cushion: Manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty includes removal and replacement of carpet and accessories required by replacement of carpet cushion.
 - 2. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 3. Failure includes, but is not limited to, permanent indentation or compression.
 - 4. Warranty Period: 10 **<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET **<Insert designation>**

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- B. **Basis-of-Design Product:** Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:
1. [Atlas Carpet Mills, Inc.](#)
 2. [Beaulieu Group LLC.](#)
 3. [Bentley Prince Street, Inc.](#)
 4. [Bloomsburg Carpet Industries, Inc.](#)
 5. [Couristan, Inc.](#)
 6. [Fortune Contract, Inc.](#)
 7. [Gulistan Carpet, Inc.](#)
 8. [Interface, LLC.](#)
 9. [J&J Invision; J&J Industries, Inc.](#)
 10. [Mannington Mills, Inc.](#)
 11. [Masland Contract; Dixie Group, Inc. \(The\).](#)
 12. [Milliken & Company.](#)
 13. [Mohawk Group \(The\); Mohawk Carpet, LLC.](#)
 14. [PacifiCrest Mills, Inc.](#)
 15. [Patcraft; a division of Shaw Industries, Inc.](#)
 16. [Philadelphia Commercial; a division of Shaw Industries, Inc.](#)
 17. [Robertex Associates, Inc.](#)
 18. [Shaw Contract Group; a Berkshire Hathaway company.](#)
 19. [Tandus; a Tarkett company.](#)
 20. <**Insert manufacturer's name**>.
- C. Color: As selected by Architect from manufacturer's full range.
- D. Pattern: As selected by Architect from manufacturer's full range.
- E. Fiber Content: 100 percent nylon 6, 6.
- F. Fiber Type: <**Insert proprietary fiber type**>.
- G. Pile Characteristic: [**Level-loop**] [**Cut**] [**Cut-and-loop**] [**Multilevel-loop**] [**Level tip shear**] [**Random shear**] [**Frieze**] [**Sculptured**] <**Insert characteristic**> pile.
- H. Primary Backing: Woven polypropylene.
- I. Secondary Backing: Woven polypropylene.
- J. Backcoating: PVC.
- K. Roll Width: **12 feet (3.7 m).**
- L. Applied Treatments:
1. Applied Soil-Resistance Treatment: Manufacturer's standard material.
 2. Antimicrobial Treatment: Manufacturer's standard material.

- a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

M. Sustainable Design Requirements:

1. Sustainable Product Certification: Gold level certification according to ANSI/NSF 140.
2. [<Double click to insert sustainable design text for carpet and cushion.>](#)

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
 1. [<Double click to insert sustainable design text for VOC content of adhesive.>](#)
 2. [<Double click to insert sustainable design text for adhesives.>](#)
- C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI's "CRI Carpet Installation Standard."
- D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- E. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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 performance.
- B. Examine carpet for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

D. Wood Subfloors: Verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 061600 "Sheathing."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

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

3.2 PREPARATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard" and with carpet manufacturer's written installation instructions for preparing substrates.
- 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. Concrete Substrates: 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 adhesive and carpet manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 CARPET INSTALLATION

- A. Comply with CRI's "CRI Carpet Installation Standard" and carpet manufacturer's written installation instructions for the following:
 1. Direct-glue-down installation.
 2. Double-glue-down installation.
- B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Install borders with mitered corner seams.
- D. Do not bridge building expansion joints with carpet.
- E. Cut and fit carpet 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 manufacturer.

- F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI's "CRI Carpet Installation Standard."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816

SECTION 09 9113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.

- B. Sustainable Design Submittals:
 - 1. [<Double click to insert sustainable design text for VOC content of paints.>](#)
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

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. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups 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.
 - 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 mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. 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. 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.

1.8 FIELD 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 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Products: Subject to compliance with requirements, [provide product] [provide one of the products] [available products that may be incorporated into the Work include, but are not limited to products] listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. [<Double click to insert sustainable design text for VOC content of paints.>](#)
- D. Colors: As selected by Architect from manufacturer's full range.
 - 1. Ten percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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 the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
 5. Portland Cement Plaster: 12 percent.
 6. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces 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 hardware, covers, plates, and similar items already in place that are removable and 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat 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. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 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.

3.6 EXTERIOR PAINTING SCHEDULE

END OF SECTION 099113

SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
 - 4. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 2. Indicate VOC content.
- B. Sustainable Design Submittals:
1. [<Double click to insert sustainable design text for paints and coatings.>](#)
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
- 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. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.
- 1.6 QUALITY ASSURANCE
- A. Mockups: Apply mockups 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.
 - 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 mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. 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. 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.

1.8 FIELD 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Products: Subject to compliance with requirements, [**provide product**] [**provide one of the products**] [**available products that may be incorporated into the Work include, but are not limited to products**] listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. [<Double click to insert sustainable design text for paints.>](#)
- D. Colors: As selected by Architect from manufacturer's full range.
 - 1. Thirty percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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 the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
 5. Gypsum Board: 12 percent.
 6. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces 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 hardware, covers, plates, and similar items already in place that are removable and 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat 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. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.

- g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
- 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 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.

3.6 INTERIOR PAINTING SCHEDULE

END OF SECTION 099123

SECTION 10 2113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Solid-polymer toilet compartments configured as toilet enclosures for group shower.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments to overhead structural system.
 - 2. Section 061000 "Rough Carpentry" for blocking.
 - 3. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

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

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

- B. Sustainable Design Submittals:

- 1. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material cost less the cost of installation for each product having recycled content.

- C. Shop Drawings: For toilet compartments.

- 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.

- D. Samples for Initial Selection: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.
- E. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 1. Each type of material, color, and finish required for toilet compartments, prepared on **6-inch- (152-mm-)** square Samples of same thickness and material indicated for Work.
 2. Each type of hardware and accessory.
- F. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

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. Door Hinges: [**One**] <Insert number> hinge(s) with associated fasteners.
 2. Latch and Keeper: [**One**] <Insert number> latch(es) and keeper(s) with associated fasteners.
 3. Door Bumper: [**One**] <Insert number> door bumper(s) with associated fasteners.
 4. Door Pull: [**One**] <Insert number> door pull(s) with associated fasteners.
 5. Fasteners: [**Ten**] <Insert number> fasteners of each size and type.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: **[25] [75] [200]** or less.
2. Smoke-Developed Index: 450 or less.

B. [<Double click to insert sustainable design text for recycled content.>](#)

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-POLYMER UNITS

A. Manufacturers:

Metpar Corporation

Bradley Corporation

Scranton Products

B. Toilet-Enclosure Style: Ceiling Hung

C. Urinal-Screen Style: Ceiling Hung .

D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, with eased edges, no sightline system, and with homogenous color and pattern throughout thickness of material.

1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless steel strip fastened to exposed bottom edges of solid polymer components to prevent burning.

E. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than **0.031-inch (0.79-mm)** nominal thickness and **3 inches (76 mm)** high, finished to match hardware.

1. Polymer Color and Pattern: [**Contrasting with pilaster, as selected by Architect from manufacturer's full range**] **<Insert color and pattern>**.

F. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Polymer Color and Pattern: [**Contrasting with pilaster, as selected by Architect from manufacturer's full range**] **<Insert color and pattern>**.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel.

2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door.
 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- E. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

- F. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at[**tops and**] bottoms of posts. Provide shoes[**and sleeves (caps)**] at posts to conceal anchorage.
- G. Door Size and Swings: Unless otherwise indicated, provide **24-inch- (610-mm-)** wide in-swinging doors for standard toilet compartments and **36-inch- (914-mm-)** wide out-swinging doors with a minimum **32-inch- (813-mm-)** wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: **1/2 inch (13 mm)**.
 - b. Panels and Walls: **1 inch (25 mm)**.
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than [**three brackets attached at midpoint and**] near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - 3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than **1-3/4 inches (44 mm)** into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each

pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than **2 inches (51 mm)** into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- E. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.
- F. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 10 2239 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Manually operated, acoustical panel partitions.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.

1.3 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Class.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .

1.5 ACTION SUBMITTALS

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

- B. Sustainable Design Submittals:

- 1. [<Double click to insert sustainable design text for recycled content.>](#)
 - 2. [<Double click to insert sustainable design text for certified wood.>](#)
 - 3. [<Double click to insert sustainable design text for certified wood.>](#)
 - 4. [<Double click to insert sustainable design text for composite wood.>](#)
 - 5. [<Double click to insert sustainable design text for adhesives.>](#)

- C. Shop Drawings: For operable panel partitions.
 - 1. Include plans, elevations, sections, details, numbered panel installation sequence, and attachments to other work.
 - 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 - 3. Include diagrams for power, signal, and control wiring.
- D. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
 - 1. Textile Facing Material: Full width by not less than **36-inch- (914-mm-)** long section of **[fabric] [carpet]** from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 - 2. Panel Facing Material: Manufacturer's standard-size unit, not less than **3 inches (75 mm)** square.
 - 3. Panel Edge Material: Not less than **3 inches (75 mm)** long.
 - 4. Chair Rail: Manufacturer's standard-size unit, **6 inches (150 mm)** long.
 - 5. Glass: Units **12 inches (300 mm)** square.
 - 6. Hardware: One of each exposed door-operating device.
- F. Delegated-Design Submittal: For operable panel partitions.
 - 1. Include design calculations for seismic restraints.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which suspension systems are attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Smoke detectors.
 - f. Access panels.
 - g. **<Insert item>**.
- B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

- C. Qualification Data: For qualified Installer.
- D. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer. Include seismic capacity of partition assemblies to remain in vertical position during a seismic event and the following:
 - 1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, according to ASCE/SEI 7.
 - 2. Detailed description of partition anchorage devices on which the certification is based and their installation requirements.
- E. Product Certificates: For each type of operable panel partition.
 - 1. Include approval letter signed by manufacturer acknowledging Owner-furnished panel facing material complies with requirements.
- F. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.
- G. Field quality-control reports.
- H. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.
 - c. Electric operator and controls.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.9 QUALITY ASSURANCE

- A. [<Double click to insert sustainable design text for manufacturer qualifications.>](#)

- B. [<Double click to insert sustainable design text for vendor qualifications.>](#)
- C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: [**Two**] **<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic bracing of tracks to structure above.
- B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the partition panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."
- C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
 - 2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC indicated.

3. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E 336, determined by ASTM E 413, and rated for **[10 dB less than STC value indicated]** <Insert value>.
- D. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: **[25]** <Insert value> or less.
 - b. Smoke-Developed Index: **[450]** <Insert value> or less.
 2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to **[NFPA 265 Method B Protocol]** **[or]** **[NFPA 286]**.
- E. Fire Resistance: Provide fire-rated operable panel partition assemblies **[including pass doors]** complying with NFPA 80, based on testing according to UL 10B for fire-rated door assemblies.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Pass doors in fire-rated operable panel partition assemblies shall meet positive-pressure requirements.
- F. 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.

2.2 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Panel Operation: Manually operated, individual panels.
- C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: [Standard widths] [Equal widths] [As indicated].
- E. STC: Not less than [38] [41] [45] [47] [50] [52] [54] <Insert number>.
- F. NRC: Not less than [0.50] [0.60] [0.65] [0.90] <Insert number>.
- G. Panel Weight: [8 lb/sq. ft. (40 kg/sq. m)] [10 lb/sq. ft. (50 kg/sq. m)] [12 lb/sq. ft. (59 kg/sq. m)] <Insert value> maximum.
- H. Panel Thickness: Not less than [3 inches (75 mm)] [3-1/2 inches (89 mm)] [4 inches (102 mm)] <Insert dimension>.
- I. Panel Materials:
 1. <Double click to insert sustainable design text for recycled content.>
 2. <Double click to insert sustainable design text for certified wood.>
 3. <Double click to insert sustainable design text for laminating adhesive.>
 4. <Double click to insert sustainable design text for composite wood products.>
 5. Steel Frame: Steel sheet, [manufacturer's standard] [0.0508-inch (1.3-mm)] [0.0641-inch (1.6-mm)] [0.0747-inch (1.9-mm)] <Insert dimension> nominal minimum thickness for uncoated steel.
 6. Steel Face/Liner Sheets: Tension-leveled steel sheet, [manufacturer's standard] [0.0299-inch (0.75-mm)] [0.0359-inch (0.9-mm)] [0.0478-inch (1.2-mm)] [0.0598-inch (1.5-mm)] [0.0747-inch (1.9-mm)] <Insert dimension> minimum nominal thickness for uncoated steel.
 7. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B 221 (ASTM B 221M) for extrusions; manufacturer's standard strengths and thicknesses for type of use.
 - a. Frame Reinforcement: Manufacturer's standard steel or aluminum.
 8. Gypsum Board: ASTM C 1396/C 1396M.
 9. Cement Board: ASTM C 1288.
 10. Particleboard: ANSI A208.1.
 11. Medium-Density Fiberboard: ANSI A208.2.
 12. Plywood: DOC PS 1.
- J. Panel Closure: Manufacturer's standard unless otherwise indicated.
 1. Initial Closure: [Flexible, resilient PVC, bulb-shaped acoustical seal] [Fixed jamb] [As indicated] <Insert description>.
 2. Final Closure: [Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal] [Hinged jamb closure] [Hinged communicating panel] [Fixed jamb] [Angle jamb] [Flexible, resilient PVC, bulb-shaped acoustical seal] <Insert description>.
- K. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 1. Hinges: [Manufacturer's standard] [Concealed (invisible)] <Insert type>.

2. <Insert hardware requirement>.

2.3 SEALS

- A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:
 1. Manufacturer's standard seals unless otherwise indicated.
 2. Seals made from materials and in profiles that minimize sound leakage.
 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
- B. Vertical Seals: Deep-nesting, interlocking[**steel**] astragals mounted on each edge of panel, with continuous PVC acoustical seal.
- C. Horizontal Top Seals: [**Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track**] [or] [**PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended**].
- D. Horizontal Bottom Seals: Manufacturer's standard continuous-contact seal exerting uniform constant pressure on floor.
- E. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
 1. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**4 inches (102 mm)**] [**6 inches (152 mm)**] between retracted seal and floor finish.
 2. Mechanically Operated for Fire-Rated Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**4 inches (102 mm)**] between retracted seal and floor finish.
 3. Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] between retracted seal and floor finish.

2.4 PANEL FINISH FACINGS

- A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 1. Apply[**one-piece, seamless**] facings free of air bubbles, wrinkles, blisters, and other defects, [**with edges tightly butted, and**] [**with invisible seams complying with Shop**

- Drawings for location, and]** with no gaps or overlaps. Horizontal **[butted edges]** **[seams]** are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
2. Where facings with **[directional or repeating patterns or directional weave]** **[directional, repeating, or matching grain]** are indicated, mark facing top and attach facing in same direction.
 3. Match facing pattern **72 inches (1830 mm)** above finished floor.
- B. Owner-Furnished Facing Material: **<Insert requirements>**.
- C. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-D for type indicated; Class A.
1. Total Weight: **<Insert value>**.
 2. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
 3. Color/Pattern: **[Match Architect's samples]** **[As selected by Architect from manufacturer's full range]** **<Insert color/pattern>**.
- D. Carpet Wall Covering: Manufacturer's standard **[nonwoven, needle-punched carpet with fibers fused to backing]**, from same dye lot, treated to resist stains.
1. Color/Pattern: **[Match Architect's samples]** **[As selected by Architect from manufacturer's full range]** **<Insert color/pattern>**.
- E. Fabric Wall Covering: **[Manufacturer's standard fabric]** **[100 percent polyolefin woven fabric]** **<Insert fabric description>**, from same dye lot, treated to resist stains.
1. Color/Pattern: **[Match Architect's samples]** **[As selected by Architect from manufacturer's full range]** **<Insert color/pattern>**.
- F. Paint: Manufacturer's standard factory-painted finish.
1. Color: **[Match Architect's sample]** **[As selected by Architect from manufacturer's full range]** **<Insert color>**.
- G. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:
1. Steel, Painted: Finished with manufacturer's **[standard neutral color]** **[color matching Architect's sample]** **[color as selected by Architect from manufacturer's full range]**.
 2. Aluminum: Finished with manufacturer's standard **[mill]** **[clear anodic]** **[color anodic]** finish.
- H. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum [**mounted directly to overhead structural support,**] [**with adjustable steel hanger rods for overhead support,**] designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than **0.10 inch (2.54 mm)** between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
 2. Head Closure Trim: As required for acoustical performance; [**with factory-applied, decorative, protective finish**] [**primed for field finish**].
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
1. Multidirectional Carriers: Capable of negotiating intersections without track switches.
- C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.
1. Curve-and-Diverter Switches: Allow radius turns to divert panels to an auxiliary track.
 2. L Intersections: Allow panels to change 90 degrees in direction of travel.
 3. T Intersections: Allow panels to pass through or change 90 degrees to another direction of travel.
 4. X Intersections: Allow panels to pass through or change travel direction full circle in 90-degree increments, and allow one partition to cross track of another.
 5. Multidirectional Switches: Adjustable switch configuring track into L, T, or X intersections and allowing panels to be moved in all pass-through, 90-degree change, and cross-over travel direction combinations.
 6. Center carrier stop.
- D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.6 ACCESSORIES

- A. Pass Doors: Swinging door built into and matching panel [**materials,**] [**construction,**] [**acoustical qualities,**] [**fire rating,**] finish and thickness, complete with frames and operating hardware. Hinges finished to match other exposed hardware.
1. Accessibility Standard: Fabricate doors to comply with applicable provisions in [**ICC A117.1**] [**and**] [**the U.S. Architectural & Transportation Barriers Compliance**]

- Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities] <Insert requirements of authorities having jurisdiction>.**
2. Single Pass Door: **[36 by 80 inches (914 by 2032 mm)] [36 by 84 inches (914 by 2134 mm)] <Insert dimensions>.**
 3. Double Pass Door: **[72 by 80 inches (1829 by 2032 mm)] [72 by 84 inches (1829 by 2134 mm)] <Insert dimensions>.**
 4. Pass-Door Hardware: Equip pass door with the following:
 - a. Door Seals: **[Mechanically operated floor seal on panels containing pass doors] [Sweep floor seals].**
 - b. **[Panic] [Fire exit]** hardware.
 - c. Concealed door closer.
 - d. Door Viewer: Installed with view in direction of swing.
 - e. Exit Sign: Recessed, self-illuminated.
 - f. Latchset: Passage set.
 - g. Lock: Key-operated lock with cylinder**[, keyed to master key system,]** operable from both sides of door. Include two keys per lock.
 - h. Lock: Deadlock to receive cylinder, operable from both sides of door. See **[Section 087100 "Door Hardware"] [Section 087111 "Door Hardware (Descriptive Specification)"]** for lock cylinder and keying requirements.
- B. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware**[and acoustical seals at soffit, floor, and jambs]**. Hinges in finish to match other exposed hardware.
1. Manufacturer's standard method to secure storage pocket door in closed position.
 2. Rim Lock: Key-operated lock cylinder**[, keyed to master key system,]** to secure storage pocket door in closed position. Include two keys per lock.
 3. Rim Lock: Deadlock to receive cylinder, to secure storage pocket door in closed position. See **[Section 087100 "Door Hardware"] [Section 087111 "Door Hardware (Descriptive Specification)"]** for lock cylinder and keying requirements.
- C. Windows: **[Manufacturer's standard] [As indicated] <Insert requirement>.**
1. Glass: Safety glass **[matching Architect's sample] [as selected by Architect from manufacturer's full range] <Insert requirement>.**
 2. Safety Glass Standard for Partition Panels: Provide glass products complying with testing requirements in 16 CFR 1201, Category II, or ANSI Z97.1, Class A.
 3. Safety Glass Standard for Pass Doors: Provide glass products complying with testing requirements in 16 CFR 1201, Category II.
- D. Work Surfaces: Quantities, placement, and size indicated.
1. Surface: **[Porcelain steel marker/projection surface] [Self-healing, tackable, vinyl-coated fabric wall covering, complying with CFFA-W-101-D, Type II, and indicated fire-test-response characteristics; laminated to natural cork tackboard] <Insert description>.**
 2. Surface Color: **[Matching Architect's sample] [As selected by Architect from manufacturer's full range] <Insert manufacturer's designation for color>.**

3. Size: [Full width and height of panel] [Full width of panel by **48 inches (1219 mm)**] [**48 by 48 inches (1219 by 1219 mm)**] [As indicated on Drawings] <Insert dimensions>.
 4. Trim: [Aluminum slip-on or snap-on trim with no visible screws or exposed joints and with corners mitered to a neat, hairline joint] <Insert description>.
- E. Chalk Tray[and Eraser Pocket]: Aluminum with [mill] [clear anodic] [color anodic] finish.
- F. Chair Rails: <Insert material, finish, dimensions, and other characteristics not indicated on Drawings>. [Recessed] [Surface mounted] in locations indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.
- F. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.[**Perform test and make adjustments before NIC testing.**]

3.3 FIELD QUALITY CONTROL

- A. NIC Testing: [**Owner will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

1. Testing Extent: Testing agency shall randomly select **[one]** <Insert number> operable panel partition installation(s) for testing.
 2. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- B. An operable panel partition installation will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust **[pass doors]** **[and]** **[storage pocket doors]** to operate smoothly and easily, without binding or warping.
- C. Verify that safety devices are properly functioning.

3.5 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **[three]** **[six]** **[nine]** **[12]** months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102239

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Private-use bathroom accessories.
4. Warm-air dryers.
5. Underlavatory guards.
6. Custodial accessories.

- B. Related Requirements:

1. Section 088300 "Mirrors" for frameless mirrors.

1.3 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.

1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

- B. Samples: Full size, for each exposed product and for each finish specified.

1. 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 accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: [15] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: <Insert products>.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser <Insert drawing designation>:
- C. Combination Toilet Tissue Dispenser <Insert drawing designation>:

- D. Toilet Tissue (Jumbo-Roll) Dispenser <Insert drawing designation>:
- E. Paper Towel (Folded) Dispenser <Insert drawing designation>:
- F. Paper Towel (Roll) Dispenser <Insert drawing designation>:
- G. Automatic Paper Towel (Roll) Dispenser <Insert drawing designation>:
- H. Waste Receptacle <Insert drawing designation>:
- I. Combination Towel (Folded) Dispenser/Waste Receptacle <Insert drawing designation>:
- J. Combination Towel (Roll) Dispenser/Waste Receptacle <Insert drawing designation>:
- K. Multipurpose Soap/Towel Dispenser Unit <Insert drawing designation>:
- L. Liquid-Soap Dispenser <Insert drawing designation>:
 - 1. .
- M. Automatic Liquid-Soap Dispenser <Insert drawing designation>:
- N. Grab Bar <Insert drawing designation>:
- O. Vendor <Insert drawing designation>:
- P. Sanitary-Napkin Disposal Unit <Insert drawing designation>:
- Q. Seat-Cover Dispenser <Insert drawing designation>:
- R. Fold-Down Purse Shelf <Insert drawing designation>:
- S. Mirror Unit <Insert drawing designation>:
- T. Coat Hook <Insert drawing designation>:

2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.
- B. Shower Curtain Rod <Insert drawing designation>:
- C. Shower Curtain <Insert drawing designation>:
- D. Folding Shower Seat <Insert drawing designation>:
- E. Soap Dish <Insert drawing designation>:
- F. Robe Hook <Insert drawing designation>:

2.5 PRIVATE-USE BATHROOM ACCESSORIES

- A. Source Limitations: Obtain private-use bathroom accessories from single source from single manufacturer.
- B. Toilet Tissue Dispenser <Insert drawing designation>:
- C. Shower Curtain Rod <Insert drawing designation>:
- D. Soap Dish <Insert drawing designation>:
- E. Medicine Cabinet <Insert drawing designation>:
- F. Facial Tissue Dispenser <Insert drawing designation>:
- G. Robe Hook <Insert drawing designation>:
- H. Toothbrush and Tumbler Holder <Insert drawing designation>:
- I. Towel Bar <Insert drawing designation>:
- J. Towel Pin <Insert drawing designation>:
- K. Towel Ring <Insert drawing designation>:
- L. Towel Shelf <Insert drawing designation>:
- M. Towel Rack <Insert drawing designation>:
- N. Retractable Clothesline <Insert drawing designation>:

2.6 WARM-AIR DRYERS

- A. Source Limitations: Obtain warm-air dryers from single source from single manufacturer.
- B. Warm-Air Dryer <Insert drawing designation>:
- C. High-Speed Warm-Air Dryer <Insert drawing designation>:
- D. Multiple Airflow Warm-Air Dryer <Insert drawing designation>:

2.7 UNDERLAVATORY GUARDS

- A. Underlavatory Guard <Insert drawing designation>:

2.8 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

- B. Utility Shelf <Insert drawing designation>:
- C. Mop and Broom Holder <Insert drawing designation>:
- D. Paper Towel (Folded) Dispenser <Insert drawing designation>:
- E. Paper Towel (Roll) Dispenser <Insert drawing designation>:
- F. Liquid-Soap Dispenser <Insert drawing designation>:

2.9 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. 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.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.10 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. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of [six] <Insert number> keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least **250 lbf (1112 N)**, when tested according to ASTM F 446.

3.2 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 instructions.

END OF SECTION 102800

SECTION 10 4413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Fire-protection cabinets for the following:

- a. Portable fire extinguishers.
 - b. Fire hose valves.
 - c. Fire hoses and racks.

- B. Related Requirements:

- 1. Section 104416 "Fire Extinguishers."
 - 2. Section 211200 "Fire-Suppression Standpipes" for fire-hose connections.

1.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site .

- 1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

- 1. Show location of knockouts for hose valves.

- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

- C. Samples: For each type of exposed finish required.

- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples **6 by 6 inches (150 by 150 mm)** square.
- F. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers and fire hoses, hose valves, and hose racks indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.7 SEQUENCING

- A. Apply decals on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- 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.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire hose, rack, valve, and extinguisher .
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Cabinet Construction: Nonrated .
- C. Cabinet Material: Stainless-steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.

- D. Recessed Cabinet:
1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as plaster stop and drywall bead.
 2. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
 3. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- G. Cabinet Trim Material: Stainless-steel sheet .
- H. Door Material: Stainless-steel sheet .
- I. Door Style: Center glass panel with frame .
- J. Door Glazing: Tempered break glass .
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting lever handle with cam-action latch .
 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- L. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 3. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 4. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle .
 5. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect .
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER ."

6. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by low voltage, complete with transformer.

M. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities .
2. Stainless Steel: ASTM A 666, Type 304.
 - a. Finish: No. 4 directional satin finish .
3. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.3 FABRICATION

- A. 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.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum **1/2 inch (13 mm)** thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose valves, racks and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- C. 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 in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, 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 104413

SECTION 10 4416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
 - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.7 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.8 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 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 - 2. Valves: [Manufacturer's standard] [Nickel-plated, polished-brass body].
 - 3. Handles and Levers: [Manufacturer's standard] [Stainless steel].
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B[, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging].
- B. Multipurpose Dry-Chemical Type in Steel Container : UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

- C. Carbon Dioxide Type : UL-rated 10-B:C, 10-lb (4.5-kg) nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 129300 - SITE FURNISHINGS

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 SCOPE OF WORK

- A. Section Includes:
 - 1. Benches
 - 2. Bicycle racks.
 - 3. Trash receptacles.
 - 4. Recycle receptacles.
 - 5. Chess Tables
 - 6. Bollards

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data
 - 2. Certificates
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For site furnishings to include in maintenance manuals.

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.

PART 2 - PRODUCTS

2.1 BENCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
1. Landscape Forms: Custom Seat wall Cap
 2. Formed metal
 3. Color: Red
 4. Size: varies – see plans

2.2 BICYCLE RACKS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
1. Forms + Surfaces: Trio Bike Rack
 2. Embedded Installation
 3. Color: Black

2.3 TRASH AND RECYCLE RECEPTACLES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
1. Victor Stanley: HD-24
 2. Embedded Mount
 3. Wood Slats: IPE
 4. LID: Self-Closing
 5. Color:
 - a. Trash receptacle: Black
 - b. Recycle receptacle: Blue, with recycle labels, see drawings

2.4 CHESS TABLE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
1. Concrete Classics: Fixed Table Set #210 w/ extra stool #250
 2. Embedded Mount
 3. Color:
 - a. Grey Concrete table and stools
 - b. Green terrazzo inlaid playing surface.

2.5 BOLLARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

1. Landscape Forms: 35 Guide Bollard
2. Embedded Mount: Lighted Bollard
3. Color: Grey
4. Lighting: LED
5. Material: Aluminum Casting

2.6 GENERAL FINISH REQUIREMENTS

A. 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 ALUMINUM FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.8 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.9 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run directional finishes with long dimension of each piece.
2. Directional Satin Finish: No 4.
3. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
- D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
- E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with [nonshrink, nonmetallic grout] [or] [anchoring cement], mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with [nonshrink, nonmetallic grout] [or] [anchoring cement], mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 129300

SECTION 13 1061 - ICE RINK REFRIGERATION AND PIPING WITH SCROLL COMPRESSORS USING R-410A REFRIGERANT

PART 1 - GENERAL

1.1 SCOPE OF WORK (BASE BID – AIR-COOLED SCROLL CHILLER)

- A. This Section of the Contract includes all Ice Rink Equipment work called for or implied by the drawings and specification, together with all necessary incidentals whether referred to or not, as will be required to complete the work to the full intent and meaning of the drawings and specifications. The specification and drawings describe a complete and operational ice skating rink. The work includes but is not limited to the following:
1. Four air-cooled chillers with scroll compressors using R-410A refrigerant.
 2. Two rink ice plant serving two ice sheets. One is Olympic size and the other is NHL size.
 3. Four air-cooled chillers with multiple scroll compressors using R-410A refrigerant - 57.5 tons each and 230 tons total.
 4. Pumps and support equipment to be located in mechanical room.
 5. Primary / secondary piping system with four primary pumps.
 6. Provide ice sheet brine secondary pumps for each ice sheet with 1 common standby pump. (3 total)
 7. 40% ethylene glycol by weight.
 8. Complete control package.
 9. Brine mains and rink piping including support spacers for 1" fusion welded HDPE SDR-11 8" header for polyethylene piping at 3 1/2" o.c.
 10. Under floor heating pipe at 18" o.c. in bed of sand below the slab on grade ice sheet. Provide 3" header with HDPE SDR-11 fusion welded piping. System shall be connected to the building heating water system.
 11. Total plant size shall be 230 tons total at 78°F outdoor wet bulb.
 12. Systems shall serve two ice sheets 40% ethylene glycol.
 13. Surface temperature of ice at approximately 18°F.
 14. Provide primary/secondary piping with a pump to serve each sheet.
 15. Supply and installation of reinforced (5,000 PSI) concrete rink slab with expansion joint. Thickness and size as shown on the drawings.
 16. Provide Zamboni heat exchanger capable of 1.2 million BTUH with 170°F supply water piping to heating water system by others.
 17. Equipment house keeping pads.
 18. Insulation of cold piping.
 19. Cutting and patching and sleeving by this Contractor for all refrigerant water and brine piping. Provide fire stopping.
 20. Power and control wiring for all refrigeration equipment specified hereunder.
 21. Pipe identification.
 22. Start-up and testing.
 23. Training.
 24. Instruction and operating manuals and as-built drawings (6 copies).
 25. Total of 12" of sand fill under the slab on grade ice sheet.

26. Floor inserts.
27. Two 2" layers (4" thick) of density 60 insulation c/w 6 mil vapour barrier.
28. Goal Post and Tennis Inserts.
29. Underslab temperature sensors.
30. Control system.
31. Fire stopping.

1.2 QUALIFICATIONS FOR REFRIGERATION INSTALLER

- A. Refrigeration Installer shall have installed a minimum of three (3) artificial ice rinks to be eligible to submit a bid on this work.
- B. The Refrigeration Installer shall have adequate personnel and equipment, and shall be approved by the Architect and Engineer.
- C. The Refrigeration Installer shall be able to satisfactorily service the equipment after installation, and shall provide 24 hour service for 1 year after acceptance of system by Owner.

1.3 RELATED WORK GENERAL

- A. The Ice Rink Contractor shall coordinate all phases of the above Scope of Work with the General Contractor, Electrical and Mechanical Contractors.
- B. Work installed and coordinated by the ice refrigeration contractor shall include the following sections:

Section 13162 - Rink Floor
Section 13163 - Ice Rink Insulation
Section 16164 - Ice Conditioning Equipment

1.4 RELATED WORK

- A. Work by Other Subcontractor(s):
 1. Trenching and back fill (buried mains), ice melt and snow melt pit and all event floor materials, equipment and accessories not spelled out in our proposal.
 2. Temporary lighting and heating will be provided. Should the Ice Rink Contractor require additional light or heat, he shall provide same in order to complete his work.
 3. 1½ inch cold water service to Mechanical Room. 1½ inch fill to cooling tower.
 4. Floor drains in mechanical room.
 5. 460/480 V, 3-phase, 60 HZ, electric service and main electric disconnect switch.
 6. 110V temporary power in equipment room for test and lighting purposes.
 7. Automatic Transfer Switchgear in event of power failure.
 8. Dasher board system by others. Coordinate ice floor with dasher board.
 9. Jet Ice system. (See Section 131064).
 10. Floor excavation to a point 18" below finished concrete floor.

1.5 CUTTING AND PATCHING

- A. Cutting and patching shall be avoided as far as possible by furnishing and insertion of sleeves and thimbles in slabs, walls, etc., as they are being built, and instructions to Contractors, leaving openings and chases for accommodation of pipes.
- B. When cutting cannot be avoided, it shall be done carefully so as not to injure the structure, and as little material as possible shall be removed. In no case shall reinforcing or structural steel be cut without the specific permission of the Architect. Openings in precast slabs shall be sleeves or precast.
- C. In case of careless or incompetent work, right is reserved to have cutting and patching done by others, and costs of same charged against the Refrigeration Installer.
- D. Refrigeration Installer shall do necessary cutting and patching for installation of his work. Surfaces shall be restored to original finish.

1.6 REFERENCED STANDARDS

- A. ANSI/ASHRAE 15 Safety Code for Mechanical Refrigeration. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. All State and local code compliance to the current edition.

1.7 SHOP DRAWINGS

- A. Provide 6 copies of shop drawings for the entire ice system. Shop drawings shall include all equipment specifications, ice floor layout, piping layout, electrical power diagrams, control diagrams and wiring, details of construction.

1.8 WARRANTY

- A. The contractor shall warranty all parts and labor of the ice rink system for a period after the acceptance of the Owner and they have assumed operation of the facility. Warranty on equipment shall be in effect for the duration of the time offered by the manufacturer of the equipment. The chiller package shall have full 2 year warranty. The concrete floor shall have a warranty for 2 years.
- B. The Refrigeration and Rink Piping Installer guarantees that he shall repair, replace, and install any or all parts, materials, or workmanship found to be defective or lacking in specified capacity as stipulated in foregoing specifications and/or shown on drawings. Guarantee includes necessary labor, as well as material and refrigerant required for repair, replacement, and/or 24 hour per day service for a year referred to above.

PART 2 - EQUIPMENT

2.1 GENERAL

- A. Manufacturers and equipment specified below are for the purpose of setting a minimum standard of capacity and quality of equipment for the performance of the ice rink system.

Provide complete R-410A air-cooled chillers system capable of producing and maintaining ice conditions year round under the following specified design criteria. Provide a minimum of four compressors per chiller.

1. Refrigeration Capacity of system is 230 tons total Refrig. Chilled water from +13°F to +10°F.
2. Ambient
 - a. Dry Bulb 94°F
 - b. Wet Bulb 78°F (mean coincident)
3. Number of Chillers 4 (air cooled)
4. 105°F ambient condensing temperature.
5. Electrical Supply: (Power) 480V/3Ph/60 Cycl.
(Control) 120V/1Ph/60

2.2 PACKAGED AIR-COOLED BRINE CHILLERS

- A. Provide four separate packaged ice chillers each with scroll type compressors. Units shall be R-410A direct expansion Ethylene Glycol having a freezing point of -13°F. (40% by weight).
- B. Chiller to be constructed to ASME code and registered by the National Board for 300 psi working pressure.
- C. Control Panel: Each chiller package shall have a NEMA 1 Control Panel with part winding starters, hand-off-automatic switches, dual pressure switches, oil failure switches, low brine temperature cutout, high oil temperature cutouts, high discharge temperature cutouts, pilot lights for compressor capacity indication and safety switches, and refrigerant and oil pressure gauges with Stedy-Mounts.
- D. Controls shall be capable of sequencing four chillers and associated pumps as a system.
- E. Refrigerant Condensers: Air-cooled integral condensers.
- F. Chillers shall be Trane CGAM-130 480/6/3 phase or equivalent.

2.3 COMPRESSORS

- A. Scroll Compressor:
1. Compressor shall be direct drive gas-cooled scroll type, R-410A compressor.

2.4 PUMPS

- A. Pumps shall be base mounted centrifugal type or inline-vertical. Iron or stainless steel construction complete with mechanical shaft seals and stainless steel shaft sleeve. Motor shall be high efficiency. Pumps shall be Bell and Gossett, Grundfos or equivalent. (See drawings for capacities).

2.5 INSULATION

- A. Piping insulation shall be installed on all brine piping. Insulation shall be 2" thick urethane or equal with vapor barrier and PVC covering.
- B. Underground piping may be pre-insulated piping. Pipe shall be Schedule 40 steel, seamless with 2" of polyurethane foam for chilled water and 1" for heating water. Provide factory applied Type 1 Class 1 PVC jacket. All fittings shall be factory prefabricated and pre-insulated. Thermacor Process or equivalent.
- C. Hot water piping shall be insulated above grade insulated with 1" fiberglass with an all purpose PVC jacket.
- D. Cold water piping shall be insulated with 1" fiberglass with all purpose PVC jacket.

2.6 THERMOMETERS, PRESSURE GAUGES AND ACCESSORIES

- A. Install 12" scale adjustable angle thermometers, scale 0 degrees to 100 degrees F., with separable sockets, where shown on drawings.
- B. Gauges shall be installed in suction discharge line of all pumps. Suction side shall be scaled 30" to 60 lbs. Discharge pressure shall be scaled 0 lbs. To 60 lbs. Dials shall be 4-1/2" diameter. Each gauge shall be valved off. Provide gauges in condenser water inlet and outlets.
- C. Furnish and install multi-purpose valves on discharge line of each brine pump. The valves shall combine a balancing valve, check valve, and shut-off valve in single body.
- D. Provide bladder expansion tanks and accessories as shown on Flow Diagram.
- E. Provide recording thermometer in discharge line of chillers.
- F. Air release valves at high points of supply and return shall be APCO Air Vent #50, 1" size. Air release valve at air separator shall be APCO 200 A, 2" size. Provide stainless steel ball valve between vent and piping, full port, full size of air valve inlet. Provide an air release valve in floor at rink header return for both heating and cooling headers. Provide access panels. Valve shall be stainless steel, lever handle ball valve.

2.7 BRINE MIXING AND MAKE-UP PUMP

- A. Provide where shown and described in detail on drawings one (1) all welded brine storage and mixing tank. Tank shall include liquid level sight glass.

- B. Pump and tank package shall include starter with running light and controls as shown on drawings. Pump shall be 3 H.P., 480 V, 3 Phase. Pump package shall be Dunham-Bush #FP6-70B, 60 gallon receiver, 3 H.P./funnel.

2.8 RINK BRINE PIPING

A. Headers

All brine piping to and from the rink floors shall be steel Schedule 40 A-53 plain end butt welded piping. All pipe shall be new, straight and true before fabrication. Provide 8" header.

The header piping shall have 1" Schedule 40, nipples welded in on 8" centers on the feed and return headers, nipples shall not protrude into the headers and must be factory fabricated, straight and true.

B. Rink Floor Pipe

All rink floor piping shall be 1" HDPE SDR-11 polyethylene pipe.

C. Pipe Chairs

Provide supporting spacers made of a minimum 3/16" steel rod fabricated with 16 gauge steel plate 3" wide on the bottom.

2.9 SUB-FLOOR HEATING PIPE

A. Headers

Header piping shall be HDPE SDR-11 polyethylene fusion welded piping. Provide 3" header.

B. Piping

Sub-floor heating pipe shall be virgin HDPE SDR-11 polyethylene 1". Provide piping at 18" o.c.

2.10 CONTROLS

- A. Provide a Monitoring and Control System which shall provide local monitoring and display of the ice rink refrigeration plant temperatures and alarms, and shall control the operation of the cooling glycol pumps and the compressors based on these temperature readings. The control system shall be interlocked with the auxiliary equipment such as the pumps and valves.

- B. Provide a prewired control panel to contain hand-off-auto selector, audible alarm horn, pilot lights and a LCD operator terminal (display and integral key pad) built into the panel door. The control panel shall sequence on chillers, pumps and valves.

- C. Equipment Specifications

1. The control system shall consist of the following:
 - a. CPU.
 - b. Digital input modules.
 - c. Discrete relay output modules.
 - d. Universal analog input modules.
 - e. Printer.
2. The door mounted operator terminal shall have a 4-line by 20 Character, 5 function keys, numeric keypad, LCD Display, and Password protection capability.
3. Temperature Transducers shall be 1000-ohm Platinum RTD, DIN 43760 with 4-20 ma interface modules, scaled to suit the individual application.
4. The operator terminal, pilot lights, switches, and interface modules shall be mounted in a prewired "NEMA-12" enclosure.

D. Alarms

1. The control system shall monitor and alarm the following safety and operating controls including data from each chiller through a BacNet interface.
 - a. Include:
 - (1) Status on each chiller
 - (2) Low cooling glycol pressure.
 - (3) Low cooling glycol flow to each chiller package.
 - (4) Low sub-floor heating flow.

This panel shall use the display capabilities of the operator interface terminal to indicate the specific alarm. The display terminal shall have the capabilities of also being a logging device which shall retain the last 100 alarm occurrences for review at any time by the operator.

2. The display shall also provide indication for the analog alarms which may occur and for which pilot lights would be impractical. The alarm queue shall also include a date time stamp for each alarm occurrence.
3. Provide a standard alarm matrix. A matrix of 8 contacts shall provide a discrete pattern for up to 63 alarm conditions. Display the current alarm pattern for a minimum of 30 seconds. After 30 seconds, any new alarm occurrence shall overwrite the existing pattern.
4. The control system shall operate the local panel mounted alarm horn, including silence feature. The operator shall be able to view the current alarm(s) as well as the previous 100 through the operator terminal.

E. Motor Run Status

1. Secondary pumps:
 - a. Cooling glycol pump No. 1.
 - b. Cooling glycol pump No. 2.
 - c. Cooling glycol pump No. 3.
2. Primary pumps:
 - a. Chiller pump No. 1.
 - b. Chiller pump No. 2.
 - c. Chiller pump No. 3.

d. Chiller pump No. 4.

F. Temperature Readings

1. The temperature sensors shall be RTD's, mounted in wells or conduit bodies.
2. The following temperatures shall be monitored and displayed through the operator terminal:
 - a. Rink Slab Temperature, (4) locations, 2 in the rink floor and 2 infra-red.
 - b. Rink Sub-Slab Temperature (2) locations.
 - c. Cooling Glycol Supply Temperature.
 - d. Cooling Glycol Return Temperature.
3. For control purposes, the operator shall be able to select the average or all of the ice rink temperature transducers to control the operation of the compressors.
4. Each temperature shall have its' own discrete high and low alarm values which can be changed through the operator terminal.
5. Control set points shall be changeable through the operator terminal with optional password protection.
6. Conduit, wiring and installation shall be by this Contractor.
7. The printer shall provide hourly print-out of reading selected by the operator.

PART 3 - EXECUTION

3.1 RINK PIPING

A. Headers

All pipe shall be new, straight and true before fabrication. Piping sizing indicated on drawings.

Provide 1" Schedule 40, nipples welded in on 8" centers on the feed and return headers, nipples shall not protrude into the headers and must be factory fabricated, straight and true. Support headers on steel channel frames on minimum 8 ft. centers.

Provide manual air release valves at return headers outside the dashers on the cooling and heating mains.

B. Rink Floor Pipe

Pipe shall be installed on 4" centers.

Return bends shall be 180 degrees on 4" centers.

All joints shall be butt welded. If electric welding is used, a "sealing bead" shall be welded first, after which the final weld is applied.

C. Pipe Chairs

Pipe chair supports shall space rink piping on 3 1/2" centers and shall be placed on 6'-0" centers down the length of the rink.

D. Testing

Rink floor and header systems shall be tested with minimum of 50 psi water pressure, 48 hours prior to pouring of concrete. Pressure shall remain on the floor for the duration of the pour.

3.2 SUB-FLOOR HEATING SYSTEM

A. General

The Ice Rink Contractor will supply and install a Sub-floor heating system consisting of a brine to heating water plate and frame heat exchanger brine circulating pump, brine mains, headers, polyethylene heating pipes and brine charge.

B. Headers

The supply and return headers shall have Schedule 80 nipples welded on 3 ft. centers to space rink piping on 18" centers or HDPE fusion welded HDPE SDR-11 piping.

C. Piping

Pipe shall be installed on 18" centers and shall be completely free of joints in the rink floor area. The only connections will be at the header end. Pipes shall be fastened by means of double clamping at the headers with Tridon S.S. 16H stainless steel clamps. Extend pipe loops 6" beyond the dasher system. Supports shall be every 4 feet on center. Alternate is fusion welded header and rink piping using HDPE SDR-11 polyethylene pipe.

D. Testing

Underslab heating pipe and headers shall be tested with a minimum of 50 psi water pressure, 48 hours prior to pouring of the concrete slab. Pressure shall remain on the floor for the duration of the pour.

3.3 INSERTS AND ACCESSORIES

A. Provide and set the Detail "A" and "B" type inserts as shown on drawings. Type "C" inserts shall be furnished and installed by dasher manufacturer. Brass plugs shall be provided for all inserts, together with two (2) plug wrenches.

B. Four sets (4) Marsh Pegs hockey goal systems shall be provided by the Refrigeration Contractor. Hockey goal inserts shall be stainless steel grooved type.

C. Care shall be taken in tack welding to avoid burning floor piping. Inserts shall be carefully lined and leveled with transit before pouring of concrete floor.

D. All inserts shall be set 1/8" below floor level.

3.4 BRINE CHARGE

- A. Provide, mix and charge into system a complete charge of DOWTHERM SR-1 brine. When system is fully charged, brine shall have a freezing point of -13 degrees F. 40% by volume. Charge shall have factory mixed inhibitor or neutralizing agent and shall be completely stabilized. One (1) full drum (55 gallons) shall be furnished as spare.
- B. Provide to Owner, at no additional cost, not less than one each three months after final acceptance of plant, for a period of one year, a chemical analysis of brine charge, together with recommendation for correction of brine, if necessary. Required corrective measures to brine for a period of one (1) year from final acceptance shall be paid by Refrigeration Installer.
- C. Copies of report shall be sent to the Owner, Architect, and Ice Rink Design Engineer.
- D. Provide Dowtherm for heating system with the same specifications as the Refrigeration System.

3.5 INSULATION AND PIPE COVERING

- A. Equipment and piping shall be tested and approved before insulation is applied. Surfaces shall be clean and dry. Insulation shall be installed only by persons regularly employed and skilled in this trade. Insulation sections or segments shall be properly cut and fitted to each surface, tightly butted together and secured. Seams and joints shall be thoroughly sealed with an approved fire retardant joint sealer as recommended by manufacturer.

Provide vapor barrier on all cold temperature pipe.

Equipment to be insulated includes chiller (insulated at factory) brine piping, heating pipe, refrigerant pipe. (See Part 2 for insulation requirements).

3.6 FLOOR AND WALL PLATES

- A. Pipes passing through finished floors or walls shall be provided with suitable split chrome-plated escutcheon plates. Escutcheon plates shall be sized to cover ends of pipe insulation and walls or floor sleeves, where such occur.

3.7 IDENTIFICATION

- A. All fabricated steel shall be primed and painted. All piping shall be painted in the mechanical room.
- B. All refrigerant lines, brine lines, and water lines pertaining to the ice rink refrigeration system will be identified after painting and insulation as to the substance in the pipe, and the direction of flow. All lines penetrating a wall section must be immediately identified on either side of the wall. Markers shall be by Brady, IIAR, or equal.

3.8 CONTROL SEQUENCE OF OPERATION

- A. The control panel for each chiller package shall be electrically interlocked with the main control panel which will control the operation of the compressors.

The starter panel shall have a number of pilot lights which indicate the following:

1. Compressor run.
 2. Compressor steps of unloading.
 3. Compressor motor anti-recycle.
- B. The compressors can not start without proof of flow to the respective chiller package. Provide safety switches and controls hard wired to each compressor control circuit, which will cause a shutdown when any of the following conditions are present:
1. High discharge pressure.
 2. Low suction pressure.
 3. High discharge temperature.
 4. High oil temperature.
 5. Motor overload.
- C. The operation of each chiller shall be controlled by infra-red and rink floor sensors. A temperature sensor in the cooling glycol return pipe shall control the chillers during non-ice events when the ice is covered. With an increase in ice surface temperature, the lead chiller shall start in the programmed sequence and load to maximum capacity as required, to maintain the temperature of the cooling glycol at the desired set point. There shall be a time delay between the starting of each compressor.
- D. The flow to the rink floor piping and glycol chiller shall be maintained by two (2) glycol brine pumps, each with one (1) standby.
- E. During ice events the operation of the chillers shall be controlled by the surface temperature of the ice rink. Two (2) infra-red cameras shall be installed in the structural system, above the ice, at each blue line. The operator shall be able to select which temperature sensor will initiate the starting of the compressors.
- F. Hot water pump recirculates maximum 100 degrees F. hot water from the plate heat exchanger to the piping grid under the rink floor. An adjustable time clock shall start and stop the heating pump. Compressor and condenser are running. If the temperature of the rink sub-floor drops below 40 degrees F., the heat pump shall run, over-riding the time clock.

3.9 ERECTION AND TESTING AND TEST RUN

- A. The above specified equipment, materials, and accessories shall be carefully installed and erected by skilled mechanics.
- B. After piping is laid on ice rink proper and connected to headers and brine connections back to chiller room are completed, test for leaks. This test must be witnessed and approved by the Architect. Brine system shall be thoroughly tested and flushed clean before brine is charged into system. This Contractor shall keep a welder on duty during the pouring of floor.
- C. All new recirculating chilled glycol systems shall be filled and flushed with an alkaline solution of a non-foaming chemical cleaner containing wetting agents, "Flush-Out Compound" or equal, to remove all foreign matter.

- D. Solution shall be circulated for a minimum of 8 hours and drained as rapidly as possible to remove all suspended particulates sloughed off by cleaning compound.
- E. The system shall be flushed with fresh water, drained a second time and then filled. After final filling, the pH of the water shall not exceed the pH of the fresh incoming water by more than 0.5 pH.
- F. Refrigeration Installer shall provide qualified engineers to supervise the operation of first run and test run of plant. Test run for freezing first sheet of ice shall be for three (3) days after pre-determined date. Refrigeration Installer shall furnish necessary help required to spray ice rink for purpose of making ice during three day test run. The Chiller Manufacturer shall provide factory start-up for the chillers. The freezing of the ice shall be under the supervision of the Jet Ice manufacturer's representative.
- G. Owner shall furnish a man who will be instructed by Refrigeration Installer's supervising engineer regarding care and operation of system. Time for starting test shall be agreed upon by Architect, an operating log-form to record operating conditions during test run. This record shall be kept by Refrigeration Installer's supervising engineer.
- H. Refrigeration Installer shall furnish three (3) complete sets of operating instructions bound in stiff covers. These manuals shall contain bulletins describing parts of equipment in refrigeration and brine circulating system, repair parts bulletin, description of methods of starting plant, instruction for summer shut-down period, wiring diagram and other material pertinent to operating and maintenance of plant. These manuals shall be turned over to Architect.
- I. Initial freezing of ice rink shall not take place until not less than twenty-eight (28) days have elapsed from time of pouring and finishing of concrete ice rink, and the completion of the expansion control system.
- J. The Refrigeration Contractor shall install the first slab of ice to 1/4".
- K. The first flood shall be made with de-ionized hot water at 160 degrees to seal the ice.
- L. Fine spray, cold or hot, de-ionized water shall be sprayed until the 1/4" thickness is achieved, to the approval of the Engineer.
- M. After miscellaneous tests and mechanical work has been completed to satisfaction of Architect, Refrigeration Installer shall give notice in writing to the Architect that he is ready to commence a test run.
- N. Upon conclusion of test run, the Architect and Engineer shall make a complete, thorough, and final inspection of the plant and will elaborate to the Refrigeration Installer in writing details that are to be corrected.

3.10 TESTING ADJUSTING AND BALANCING

- A. Refrigeration contractor shall contract with a test and balance firm to test, adjust and balance the hydronic system. Also Contractor shall have a registered engineer responsible for the work and shall have prior approval by the Architect/Engineer. Testing

shall be done by certified technicians.

B. References

1. ASHRAE - Standard 111 - 1988 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air Conditioning, and Refrigeration Systems.
2. ASHRAE - 1987 HVAC Systems and Applications Handbook: Chapter 57, Testing, Adjusting and Balancing.
3. NEBB - Procedural Standards for Testing, Balancing, and Adjusting of Environmental Systems.

C. Submittals

1. Submit name of Adjusting and Balancing Firm for approval within thirty (30) days after award of contract.
2. Submit for review, prior to commencement of work, a list of equipment and procedures to be used in balancing the systems.
3. Submit reports of pre-construction plan check and periodic mechanical construction review.
4. Submit draft copies of report for review prior to final acceptance of project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.

D. Procedures and Report

1. Hydronic Systems shall be balanced using a procedure which results in minimum restrictions being imposed. At completion of balancing provide a report with the following information.
 - a. Instrument List:
 - (1) Instrument
 - (2) Manufacturer
 - (3) Model
 - (4) Serial number
 - (5) Range
 - (6) Calibration date
 - b. Electric Motors:
 - (1) Manufacturer
 - (2) HP
 - (3) Phase, voltage, amperage, nameplate, actual
 - (4) RPM
 - (5) Service factor
 - (6) Starter size, rating, heater elements
 - c. Pump Data:
 - (1) Identification/number
 - (2) Manufacturer
 - (3) Size/model
 - (4) Impeller diameter
 - (5) Service
 - (6) Design flow rate, pressure drop
 - (7) Actual flow rate, pressure drop

- (8) Discharge pressure
- (9) Suction pressure
- (10) Total operating head pressure
- (11) Shut off, discharge and suction pressures
- (12) Shut off, total head pressure
- d. Chillers:
 - (1) Identification/number
 - (2) Manufacturer
 - (3) Capacity
 - (4) Model
 - (5) Evaporator entering glycol temperature, design and actual
 - (6) Evaporator leaving glycol temperature, design and actual
 - (7) Evaporator pressure drop, design and actual
 - (8) Evaporator glycol flow rate, design and actual
 - (9) Condenser entering water temperature, design and actual (including heat recovery side)
 - (10) Condenser leaving water temperature, design and actual (including heat recovery side)
 - (11) Condenser pressure drop, design and actual
 - (12) Condenser water flow rate, design and actual
- e. Glycol Flow Measuring Station:
 - (1) Identification/number
 - (2) Location
 - (3) Size
 - (4) Manufacturer
 - (5) Model
 - (6) Design flow rate
 - (7) Design pressure drop
 - (8) Actual/final pressure drop
 - (9) Actual/final flow rate
 - (10) Station calibrated setting
- f. Sound Level Report:
 - (1) Location
 - (2) Octave bands - equipment off
 - (3) Octave bands - equipment on
- g. Vibration Test:
 - (1) Location of Points:
 - (a) Fan bearing, drive end
 - (b) Fan bearing, opposite end
 - (c) Motor bearing, center (if applicable)
 - (d) Motor bearing, drive end
 - (e) Motor bearing, opposite end
 - (f) Casing (bottom or top)
 - (g) Casing (side)
 - (2) Test Readings:
 - (a) Horizontal, velocity and displacement
 - (b) Vertical, velocity and displacement
 - (c) Axial, velocity and displacement
 - (3) Normally acceptable readings, velocity and acceleration
 - (4) Unusual conditions at time of test
 - (5) Vibration source (if non-complying)

- h. Rink Sensor Temperatures: (Sub Floor and Rink Floor)
 - (1) Description of sensor under test
 - i. Rink Brine Temperature:
 - (1) Temperature leaving rink
 - (2) Temperature entering rink
 - 2. Report is to include a listing of any abnormal or notable conditions not contained in above.
 - 3. Provide four (4) copies of reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- E. Contractor Responsibilities
- 1. Prepare each system for testing and balancing.
 - 2. Cooperate with testing organization, provided access to equipment and systems. Operate systems at designated times, and under conditions required for proper testing, adjusting and balancing.
 - 3. Notify testing organization seven (7) days prior to time system will be ready for testing, adjusting and balancing.
- F. Examination
- 1. Before commencing work, verify that systems are complete and operable. Ensure the following:
 - a. Equipment is operable and in safe normal condition.
 - b. Temperature control systems and rink dehumidification system are installed complete and operable.
 - c. Proper strainer baskets are clean and in place.
 - d. Correct pump rotation.
 - e. Proper strainer baskets are clean and in place.
 - f. Service and balance valves are open.
- G. Installation Tolerances
- 1. Adjust Hydronic Systems to the following tolerances:
 - a. Heating System:
 - (1) Supply glycol temperature 60 degrees - 100 degrees F: 0% to +10% of design value.
 - (2) Supply water temperature 120 degrees to 160 degrees F: 5% to +10% of design value.
 - b. Chilled Glycol System
 - (1) Supply glycol temperature below 45 degrees F: -5% to +5% of design value.
- H. Adjusting
- 1. Recorded data shall represent actually measured, or observed condition.
 - 2. Permanently mark settings of valves, dampers, and other adjustment devices, allowing settings to be restored.

3. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
4. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

END OF SECTION 131061

SECTION 13 1062 - RINK FLOOR

PART 1 – GENERAL

1.1 SCOPE

- A. The Ice Rink Contractor will be responsible for the proper supervision and installation of the rink slab from the structural slab including drainage composite, 4” of insulation, vapor barrier, reinforcing, concrete, and floor inserts for hockey and other sports.
- B. Warranties: The flooring contractor shall guarantee floor for a period of two years after the successful completion and approval by the Owner’s representative. The guarantee shall cover dusting, disintegration or any other defects of the surface coming within the control of the Contractor.

PART 2 - MATERIALS

2.1 REINFORCED REFRIGERATED CONCRETE SLAB

- A. Provide all labor, materials, equipment, services and protection for the complete installation of a reinforced concrete slab. The rink floor shall be reinforced concrete slab with a minimum thickness of 6” or as noted on drawings. The total thickness of the concrete over the freezing pipes shall not exceed 1-1/2”. Provide 6 mil poly sheeting vapor barrier between the insulation and slab bottom surface. Tape all joints to provide a waterproof seal.
- B. Expansion Joint Compression Seal: Furnish and install a 1” compression seal expansion joint system for the ice slab as manufactured by Watson Bowman Acme.

The seal shall be performed and manufactured from a thermoplastic rubber compound.

Lubricant Adhesive - Rima-Lub Adhesive shall be a one part moisture curing polyurethane and aromatic hydrocarbon solvent moisture which complies with ASTM D-4070.

PART 3 - INSTALLATION

3.1 REINFORCING STEEL

- A. The slab will be reinforced with #4 bars at 12” centers in both direction below the pipes. All bars will be intermediate grade deformed steel free from rust or scale without sharp offsets or bends. Longitudinal bars for bottom reinforcing will not be less than 20 ft. lengths and the minimum lap will be 1’-5”. The bars will be placed beginning 4” clear of the bulkhead on each

side and ends of the rink.

- B. The first layer of #4 re-rod shall be laid parallel to the rink pipe supports at 12" centers. The second layer of #4 re-rod shall be laid longitudinal at 12" centers over the first layer of re-rod and the base plate of the rink pipe supports.
- C. The two layers of reinforcing steel below the pipe will then be tied together with wire ties at a minimum of 12" intervals in two directions. Provide WWR 6x6 – 10/10 directly above and tied to the pipes. Lap one complete mesh panel.

3.2 CONCRETE MIX AND INSTALLATION

- A. The concrete mix will be designed with admixtures to produce a compressive strength of 5000 psi in 28 days. Any concrete admixtures shall be compatible with the specified ice rink floor piping. The mix design must be approved by the Owner's representative. Aggregate must be clean and properly graded with a maximum size of 3/4". Maintain a slump that will allow the concrete to flow around the piping system.
- B. The concrete slab will be poured in place using a concrete pump with a minimum output of 35 cr. yds. per hour. No trucks are to be allowed in the floor area and the use of power operated buggies will not be permitted. A stand-by pump shall be provided.
- C. Runways will be 4' x 8' x 3/4" plywood sheets in good structural condition laid on the pipe chair supports.
- D. Concrete will be placed in 10 ft. - 12 ft. lanes running transversely across the rink starting at the one side and maintaining this same direction each time so that new concrete will be placed against the oldest concrete on the previous lane. Care must be exercised to prevent damage to the piping system.
- E. After concrete placing has been commenced it must be carried on continuously until completion. The changing of shifts must be done so that there is no delay in pouring and meal hours for the crew must be staggered to avoid any stoppage in the pouring. The concrete shall be struck off and finished with rotary steel floats until all laitence has disappeared.
- F. Testing: Testing of the concrete will be provided by the Owner's special inspector. It will be the Ice Rink Contractor's responsibility to coordinate this testing with the Owner's special inspector. Test cylinders will be taken to a total of six throughout the pour and will be tested for compressive strength at 7 days and 28 days. Cylinders are to be stored at the project, under the same conditions of temperature and moisture as the floor, until tested.
- G. Surface Tolerances: The rink slab shall be installed in accordance with the following ACI tolerances:
 - 1. $F_f = 65(\text{overall})/F_f = 45(\text{local minimum})$
 - 2. $F_l = 50 (\text{overall}/F_l = 30 (\text{local minimum})$
 - 3. Top of slab elevation shall deviate no more than +/- 1/8" from a horizontal, level plane at the top of ice slab.

- H. Finishing: The surface of the slab shall be finished with power driven rotary trowels following immediately behind the pouring crew.
- I. Hardener: When the slab is in condition to receive a hardener, a non-metallic hardener shall be uniformly applied as recommended by the manufacturer to ensure a smooth even finish free of all irregularities and blemishes. Hardener shall be applied at the rate of 60 lbs. Per 100 sq. ft. of surface. Other alternates of hardeners can be submitted for approval.
- J. Curing and Protection: A continuous moist cure shall be maintained during the finishing process for a period of 7 days. On completion on finishing the entire slab area shall be covered with polyethylene sheets with care being taken to lap all joints. Polyethylene is to remain in place free of traffic for a period of ten days. The Ice Rink Contractor is responsible for protection against vandalism damage through the hardening process for a further period of 7 days.
- K. Complete flatness and levelness testing described in section 03 30 00 and submit data to Architect for review.

3.3 EXPANSION JOINT INSTALLATION

- A. All surfaces to receive elastomeric compression seal shall be free from dirt, water, frost and any other loose foreign debris which may be detrimental to effective joint sealing.
- B. The seal shall be supplied in the longest continuous length possible. Factory splices will be allowed.

3.4 PERIMETER EMBEDDED EDGE ANGLE

- A. Allowable deviation of top of embedded edge angle elevation from design geometry = +/- 1/16" vertical from all sources of error, including warping and placement tolerances.

END OF SECTION 131062

SECTION 13 1063 - ICE RINK INSULATION

PART 1 – GENERAL

- 1.1 This Contractor shall furnish and install the following:
- A. Two (2) layers of insulation in thickness as shown on drawings.
 - B. Vapor Barrier.

PART 2 - MATERIALS

- 2.1 INSULATION
- A. Rink insulation shall be Dow Styrofoam 60 Hi-Load insulation, supplied in sheets 2'-0" x 8'-0".
- 2.2 Vapor barrier shall be Sisalkualt Moistop, with fortified grade 495 pressure sensitive tape.

PART 3 - INSTALLATION

- 3.1 Install vapor barrier under insulation. All joints shall be overlapped no less than 6" and sealed with fortified grade 495 pressure sensitive tape.
- 3.2 The insulation shall be applied in two layers. Joints between layers shall be staggered in both directions. Final surface shall be leveled to plus or minus 1/8". After level has been checked by Engineer, insulation is to be glued.
- 3.3 The vapor barrier on top of and below the insulation shall be provided by this Contractor. Vapor barrier shall be Fortifiber Poly Foil Barrier laid with all joints lapped six (6) inches, and sealed as above.

END OF SECTION 131063

SECTION 13 1064 – ICE CONDITIONING EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Provide and install an ice conditioning and maintenance for the ice system. The system shall consist of a water conditioning and heating system plus maintenance tools as noted in the specifications.

PART 2 - PRODUCTS

2.1 WATER TREATMENT AND HEATING SYSTEM

- A. The Water Treatment System Installer shall install a complete and operational system equal to Jet Ice Pro Ice System. The system is capable of providing a continuous supply of quality water for the purpose of ice making, at the rate of nine (9) gpm to storage reservoir. System design will meet facility ice in and on going flood water demands. The Pro Ice System shall include the following components:

1. Water Softener: Removal of hard ions from the water source up to 20 US gpm.
2. Carbon Filter: Removal of organics and chlorine from the water source up to 20 US gpm.
3. Pro Ice Unit: Production of demineralized water w/ five (5) micron sediment pre-filter.
4. Storage Reservoir: Temporary storage of treated water.
5. On Demand Distribution Pump: Supply treated water to heating system and/or point of use.
6. I.Q.S: Designed to control ice quality for various ice event programming. Operator controlled to neutralize “crawling” of the ice surface.

- B. **PRE-TREATMENT**

1. Water Softener: The system will include a duplex 16” water softener unit with a capacity of 240,000 grains of hardness, to provide uninterrupted supply. Tanks are glass fiber reinforced polyester with a working pressure rated at 120 psi (Hydrostatic test pressure 300 psi). The unit is an alternating twin tank design with meter-initiated regeneration.
2. Carbon Filter: The system utilizes premium Coconut Carbon media and will include a duplex 16” automatic carbon filter system with 1” inlet. Tanks are glass fiber reinforced polyester with a working pressure rated at 120 psi (Hydrostatic test pressure 300 psi). This unit will provide an uninterrupted supply.
3. Prefilter: A replacement type element filter will be provided to assure proper protection of the Pro Ice® Demineralizer membrane. The filter elements will be of polypropylene construction and rated at five (5) micron nominal size removal. The filter is 4 1/2” x 20” capable of up to 20 US gpm.

C. PURIFICATION

1. Pro Ice Unit: System will include a Pro Ice® Demineralizer unit designed to provide a continuous supply of treated water to meet the freezing rate demands of a multi -purpose facility.
2. Pressure Pump: A stainless steel multi-stage pump and motor assembly will be provided to boost the incoming water to an operating pressure of 150 psig. The pump will be mounted vertically to minimize floor space requirements. It will be direct-coupled to a 2 hp electric motor operating at 230/240V/60HZ/ 1PH/30AMP. The pressure pump will be powered through a thermal overload relay to protect the pump motor from overheating.
3. Pro Ice Module: The unit will use elements in a spiral-wound modular configuration. The elements will be polyamide thin film composite membrane type and will be capable of producing water at least 95% free of dissolved solids. Performance is based on standard conditions of feed water at 77 degrees F containing 1500 ppm NaCl and an operating pressure of 150 psi. The module assembly will consist of six (6) – 4” diameter by 40” long high flow elements. Element housings will be constructed of FRP for corrosion resistance. Modules will be connected in a series, multi-stage arrangement to deliver the design capacity by using a waste recycle system to minimize waste flow requirements.
 - a. Enclosure: All of the components will be mounted on an open type, freestanding welded steel frame finished in a durable powder coating for resistance to corrosion and neat in appearance. The electrical control components will be housed inside this enclosure. The pressure gauges, flow indicators, waste flow control valve will be mounted on a protective metal frame below the control panel for ease of control and monitoring.
 - b. Protection Features: A pressure switch will be installed after the inlet water solenoid. This will protect the pressure pump from cavitation by shutting down the inlet solenoid valve and pump should the inlet pressure fall below 20 psi for more than five (5) seconds. A ‘low pressure’ indicator light will be installed on the front panel to allow the operator to correct the condition and re-start the unit. For membrane protection, the unit will be equipped with time delay startup.
 - c. Auto Flush: Unit will automatically flush debris from membrane, extending membrane life.
 - d. Controls: The equipment will include all mechanical, hydraulic and electrical controls for a complete, self-contained unit. Operation of the unit will be controlled by an ‘on / off’ switch located on the front of the cabinet. The switch will include a light to indicate when electrical power is on. Connections will be provided to allow easy installation of the liquid level control, which will shut down the unit and prevent overflow of the product water storage tank if one is used and becomes full. A ‘storage full’ indicator lamp will be installed on the front panel of the cabinet to indicate this condition. A 'running' indicator lamp will also be installed on the front panel to indicate water production. Two (2) liquid filled pressure gauges will be installed to indicate the feed and module pressure of the unit. These gauges will indicate to the operator when a replacement cartridge is required. A third pressure gauge to monitor system pressure is included. Two (2) clear rotameter flow indicators will also be mounted on the front of the cabinet to show the rate of production flow and the rate of waste flow. The unit will also be equipped with LCD Total Dissolved Solids meter for monitoring quality of product water at all times.

- e. Waste Water: The unit will be equipped with stainless steel throttling valve to permit adjustment of the waste flow. The adjusting handle will be located on the front of the cabinet for operator convenience.

D. STORAGE TANK AND DELIVERY PUMP

- 1. The demineralized water will be fed to two 750 gallon polyethylene closed top storage tanks. Level controls in the tank will control feed to the tanks.
 - 2. On Demand Distribution Pump: The water distribution pump shall be of stainless steel construction capable of producing up to 20 gpm of flow at 50 psi pressure. A liquid filled gauge to monitor pressure will be included. The two (2) hp pumps shall deliver water to process upon signal of open valve for floodwater delivery and shall be protected with low-level cutoff. A pressurized well tank used in combination with the distribution pump shall ensure proper operation and consistent flow to the point of use.
 - 3. Provide all piping, valves, expansion tanks, gas-fired water heaters, gauges, thermostatic mixing valve and water meter from 1" HW and 1" CW valve rough-in provided by Division 22 in the Zamboni Room. All water piping shall be Schedule 80 Hi-Temp CPVC pipe. Supply 1 1/4" CPVC SCH 80 water line from Pro Ice System to Zamboni fill station not to exceed 30 feet. Terminate with a stainless steel ball valve with a hose connection.
- E. The Jet Ice Installer shall provide two 85 gal., 500 MBH input gas-fired water heaters, equal to AO Smith BTR-500(A).
- F. The water treatment and heating system shall be warranted against defects in equipment and workmanship for a period of one (1) year from first date of use.
- G. Provide one valved 77 degree domestic water supply, minimum 50 psi, maximum 70 psi, (Symmons 5-500 mixing valve (1" inlet and 1 1/4" outlet) or equivalent with a minimum flow rate of 25 GPM), within 5' of the equipment pad. 1" hot water 1" cold water rough-in by Division 22.

PART 3 - INSTALLATION

- 3.1 This contractor is responsible for all installation of equipment, piping, insulation and coordination with other trades.
- 3.2 After Water Treatment System is installed, the Water Treatment Contractor shall provide two (2) days of training for Owner's operating personnel on Water Treatment System and painting of the ice surface.
- 3.3 INSULATION
- A. Insulation of hot water lines from hot water heaters to Zamboni fill station shall be 1" fiberglass with all service jacket.

- B. Insulation is the responsibility of this contractor. It can be sub-contracted to the insulation contractor under Division 15.

3.4 COORDINATION

- A. One (1) - 3" floor drains shall be provided for the Jet Ice System by Division 22.
- B. A 1" cold water and 1" hot water rough-in to the area will be provided by the Division 22 Contractor.
- C. Power will be provided to the area by Division 26. The Ice Contractor shall be responsible for final connection of power.
- D. Coordinate backflow preventer installation with Division 22.

3.5 WORK BY OTHERS

- A. A concrete pad 4" high for the Pro Ice System.
- B. 1" cold water and 1" hot water rough-in to the area will be provided by the Division 22 Contractor.
- C. Power will be provided to the area by Division 26. The Ice System Contractor shall be responsible for final connection of power.
- D. Complete hook-up, wiring and proper sized power disconnects for the Jet Ice hot water heaters at or near the equipment pad.
- E. Electrical connection with power disconnects for water treatment controls and pumps - 230 / 240V / 60 Hz / Single Phase / 30 Amp.
- F. Electrical connection for pre-treatment - One (1) - 110V Quad Receptacle
- G. 1 – 3" floor drain on or within 5' of the equipment pad
- H. Backflow Preventor, where required by local codes and authorities by Division 22 Contractor.
- I. Cutting, coring or drilling of any concrete or block walls
- J. Any changes to material and design to conform to local code
- K. All necessary permits / approvals / state / provincial / federal and local taxes.

END OF SECTION 131064

SECTION 13 2000 - ALUMINUM FRAME DASHER BOARD SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes all necessary labor and materials for the supply and installation of the following:
 - 1. One (1) complete dasherboard, 85' x 200', removable system:
 - 2. Aluminum frame dasherboards as base bid
 - 3. Team boxes
 - 4. Penalty boxes
 - 5. Scorekeeper's box
 - 6. Cast Acrylic spectator shielding
 - 7. Ice dam
 - 8. Transport/storage equipment
 - 9. Attic stock of spare components
 - 10. Motorized netting system

1.3 COORDINATION

- A. Dasherboard Contractor shall provide inserts for Dasherboard anchorage in ice slab floor prior to concrete being poured by others. Contractor to coordinate location of inserts with slab reinforcing and slab refrigeration system.
- B. Coordinate with the General Contractor for electrical access requirements to allow installation of all necessary electrical equipment such as microphones, scoreboard controls and power supply to winch motors for netting system, etc.

1.4 ACTION SUBMITTALS

- A. General
 - 1. The Dasherboard Contractor shall submit eight (8) sets of full shop drawings on the total package
 - 2. Submit color and gauge samples of all plastic, steel and any other materials necessary for approval (if required by the Consultant).

3. Submittal shall be in accordance with Section 01340, "Shop Drawings, Product Data and Samples".

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. The systems installed shall provide complete, operable aluminum frame dasherboard systems under the base bid including gates, protective spectator and player shielding, and all necessary accessories for the ice rink as specified herein.
2. Manufacturers other than those named in Part 2.1 wishing to quote must provide the Architect with complete Shop Drawings and details meeting the specified design features, and must supply evidence of at least five installations, similar to these specifications.
3. No systems, including wood components or field welded fabrication will be considered.
4. All systems must be compliant with current NHL requirements including but not limited to size, flexibility and including curved acrylic corners at players boxes and VIP boxes. NHL approved posts pads are required for camera boxes with posts locate 20" back from line of in play shielding.
5. Warranty provides a two year written warranty (excluding spectator shielding)

1.6 DELIVERY, STORAGE, AND HANDLING

- A. All materials and equipment shall be delivered to the site by the manufacturer and installer. The General Contractor shall be responsible for the safe storage of materials until Dasherboard Contractor arrives on site.
- B. All materials shall be stored off the ground and shall be covered.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cascadia Sport Systems Inc. - 7000A-CV Professional Aluminum Dasher Boards (As basis of Design)
- B. Becker Arena Products, Inc.
- C. Crystalplex - Athletica, Inc.
- D. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

- A. The Contractor shall furnish and install new aluminum frame system dasher boards utilizing clear cast acrylic shielding system, around the entire system, as shown on drawings.

2.3 ALUMINUM FRAME DASHERBOARD SYSTEM

- A. The Contractor shall include the furnishing and installation of new dasherboards
- B. Materials and Equipment: Materials and equipment shall conform to respective manufacturers' publications and in addition to all requirements as specified herein. Other materials and equipment shall be specified elsewhere herein, and shall be the products of manufacturers regularly engaged in the manufacture of such materials. Items of equipment shall essentially duplicate equipment that has been satisfactorily used for a period of at least five (5) years in the NHL or AHL buildings.
- C. Dasher Panels:
 - 1. Dasher panels shall be fabricated in demountable sections. The design of all panels, whether straight section, curved section, or section in which a gate is located shall be similar. Framing for each section shall be factory prefabricated, made from high strength aluminum tubes, shapes, plates and bars used at the top, intermediate, and base location. All connections shall be welded.
 - 2. Each end channel or plate will have two matching holes to accommodate not less than 5/8" through bolts.
 - 3. Each panel to provide a continuous slot for anchoring panel to the ice retainer with not less than two (2) 5/8" diameter steel anchor bolts. Dasherboard inserts shall be electroplated after fabrication.
 - 4. An additional rectangular aluminum tube shall be welded to the top and back of each panel to aid in the fastening of the top cap rail to the panel.
 - 5. Each panel is to be completely welded construction. Ends of all horizontal stringers that are welded to the end channels or plates shall be specially prepared so that the horizontal stringers can be welded on all sides for strength and rigidity. All exterior welds will be ground smooth to provide a continuous flush appearance.
 - 6. Aluminum used in the construction of the dasherboard framing shall be allow #6061 T6 or #6063 T5 high strength aluminum.
 - a. The Dasher Contractor shall supply anchors imbeds. These imbeds are to be constructed from 4" x 3" x 3/8" steel plate with a 5/8" threaded rod equipped with an adjustable rod coupler. This assembly is to be cast into the refrigerated slab allowing for the top of the rod coupler to 1/16" below the elevation of the finished ice slab.
 - 7. Each dasher panel shall be anchored to the steel channel ice dam using a minimum of four (4) 5/8" anchors per 8' panel and three (3) for each 4' gate section.
 - 8. The anchor imbeds shall be installed in the rink floor system by the General Contractor. Imbed plates are to be constructed of 3 1/2" x 4" x 3/8" flat plate with 5/8" threaded rod and adjustable coupling.
 - 9. On panels that required red and blue lines, they are to be installed using 1/2" high density polyethylene in these areas, attached to 1/2" white installed backer panels spanning on both sides of line.

10. The 1/2" polyethylene shall be attached to the horizontal and vertical tubing with 1/4" plated and painted screws. Spacing of the screws shall not exceed 8" on center along all steel framing. HDPE on the ice dam will be secured with stainless steel screw.

D. Caprail:

1. Caprail shall be high density polyethylene 1" thick and shall be fastened to the top horizontal framing members. The front and back edges of the caprail shall have smooth and radiused edges. Color to be selected by Architect from standard colors.

E. Gates

1. Access gates (3'-0" wide or wider as shown on plan) and player gates (2'-6" wide) shall be built into 8' panels, left or right hand swing. The gate latch shall be equipped with a counter balanced mechanism so that the gate may be closed and latched in a single movement. There shall be two (2) hinges for access and player gates with glass, lift-off type, bolted to the frame. All access and player gates shall have two (2) door stops bolted to the gate frame. Gates shall be placed as shown in the ice rink floor plan. For gates with glass shields, where operation of the latch system is required by hockey players, a push button latch shall be incorporated, and be large enough to allow operation by players wearing gloves. Exposed fasteners or mounting plaes will not be acceptable. Bottom of gates in boxes shall be coordinated to function with the elevated box flooring. Players gates without glass will be equipped with HD piano hinges. All hinges are to be equipped iwth a means to adjust over time to deal with wear and tear.
2. Equipment gates shall be double leaf gates to size as shown on drawings. The equipment gate hinges shall be two adjustable, lift-off type, bolted to each of the two frames. Equipment gate latch is to have two sliding bars type 2" x 2" steel tubing with a large grasp handle. Each equipment gate shall lock into the steel threshold sleeve by means of 3/4" x 12" long cane bolts. Each equipment gate leaf shall be quipped with spring loaded adjustable castors.

F. Hardware

1. All steel hardware shall be galvanized or zinc-plated for rust resistancy after welding. Hardware shall include hinges, latches, nuts, bolts, washers and miscellaneous fastening devices necessary for complete installation.

G. Kickplate

1. Kickplate shall be construction of 1/2" thick high density polyethylene 7 7/8" high. The top edge of the kickplate shall be beveled. Color to be selected by Architect from standard colors

H. Thresholds:

1. All metal threshold framework to be covered with natural white 1" thick stress relieved polypropylene.
2. Access and player gates shall have 1" thick high density polyehtylene thresholds that can be removed and replaced when wearing occurs. Thresholds to be attached to steel framework with countersunk screws.

I. Spectator Shield Mounting Hardware:

1. Base bid is to include standard one piece "Clearvision" polycarbonate support posts for all common posts where acrylic glass extends out both sides of the post. For shielding termination posts like found at and on all gates use one piece extruded aluminum 90 degree posts with internal gaskets to insure snug fit.

J. Spectator Shielding

1. Spectator shielding shall be clear cast acrylic having a minimum thickness of .500".
2. Standard sized shielding: 5' wide x 8' tall on ends and corners, 8' wide x 6' tall on sides.
3. Sloping transition sections shall be provided at all points of height change.
4. Shield supports shall be within 6" of the top of acrylic. Common posts are to be equipped with support clips made from clear polycarbonate, providing wings that provide additional containment of acrylic. These clips are to provide a minimum of 2" of additional support on each side of post.
5. The shielded supports at both ends of the players boxes and the corners for a center ice VIP booth are to be compliant with the NHL requirements. These requirements include a curved piece of acrylic and energy absorbing post system. The complete system must be tested and approved by ARRC and have received written approval by the NHL.

K. Boxes:

1. Boxes shall consist of two team boxes, two penalty boxes and one scorer's box, of the length as shown on plans.
2. Spectator shielding shall be installed behind and along side of, but not in front of player boxes as noted on the drawings. Shielding shall be installed behind, along side of and in front of penalty and scorer's box as noted on drawings.
3. The rink dasherboards, within the team and penalty boxes themselves, shall be backed to prohibit the users from kicking at the backside of the dashers; as well as the skate blades being kicked against metal structure. This is to be done with 3/8" pigmented white high density polyethylene sheets. Water bottle ledges shall be provided in player boxes.

L. Elevated Flooring

1. Include for elevated removable flooring in all boxes including tubular aluminum framework, 3/4" pressure-treated plywood, 3/8" loose rubber skate flooring. Framework to be constructed using 1 1/2" x 1 1/2" x 1/8" tubing on 16" centers.

M. Benches:

1. The benches used in the players and penalty box areas shall be made of 2" x 9 1/2" solid HDPE bench top secured to galvanized steel support structure.
2. The tube supports shall not exceed 3'-0" on center and shall be attached to the benches with 3/8" carriage bolts (4 per plate) and 3/8" lock nuts.

N. Ice Dam:

1. Provide galvanized steel channel 2" x 6" (8.2lbs per ft), covered on top and front side with 1/2" HDPE to match kick strip. Ice Dam to have 1 1/2" rigid insulation glued to the interior where possible. Ice Dam is to be attached to the refrigerated ice slab.

O. Transport and Storage Carts:

1. Provide sufficient shield storage racks, stackable dasher board panel racks and rolling post carts to store all dashers, shielding and posts for entire rink. Provide "special" storage rack designed to hold one of every standard sized and special sized shielding panel in a manner that will allow the removal of any panel without having to move any other of the adjacent panels. Each cart is to be equipped with 5 HD castors that are bolted to the cart to allow for easy replacement.

P. Lift Outs:

1. Provide lift-out sections as noted on the drawings to allow for access to the event floor through the dasher boards at the aisle locations required. No tools are required to assemble and disassemble uprights.

Q. Spareas:

1. Provide two (2) pieces of each standard size glass panel, one (1) piece of each "special" size glass panel, two (2) pieces of each size of support posts for the glass, and two (2) pieces of matching colored plastic for puckboard, top sill and kick strip.

R. Backer panels - Quick Release Style

1. 3/8" white HDPE panels with tubular aluminum framework attached, equipped with toggle style cam action locking brackets at the top of the panel, bottom of the panels attached by spring style wrap around clips to secure panel to dasher panel.

S. Closure Angle

1. Approx. 3" x 3" x 3/16" aluminum angle attached to the backer panel to close off any gap between the edge of the seating platform and the back of the dasher panel. In the radius corners it is expected that seating platforms will follow the curve of the back of the dasher board so that there would be no need for a gap closure greater in the corners than the sides or ends of the rink.

T. Barrier Netting:

1. The only complete motorized retractable barrier netting systems including:
 - a. NHL approved Kevlar netting sized to suit this building for both ends and 4 corners with 1 1/2" x 1 1/2" HSS steel tubular contoured lifting bars.
 - 1) 2 Remote controlled 1000 pound capacity winch systems with control cabinets, keyless remote controllers

- b. 14 ceiling attached pulley blocks
- c. 14 sets of 3/16" aircraft cable.
- d. 2 only cable collection blocks and clew assemblies.
- e. Winch System and Motor:
 - 1) Max. Safe Working Load 1000lbs. of netting weight plus 400 lbs of additional tension
 - 2) Load type Vertical lift of safety netting.
 - 3) Rope type 1/4" / 6mm 7 x 19 aircraft cable. Rope not supplied with winch.
 - 4) Rope travel 110 feet/ 34 meters on two layers.
 - 5) Rope Speed (feet per minute) 10 feet per minute/ 3 meters per minute
 - 6) Electrical Characteristics 110 Volts, 60 cycle. Other voltages and frequencies on special order
 - 7) Motor 1 HP/ .75 KW
 - 8) Full Load Amperage 13 amps.
 - 9) Manufacturer: Tork Winch Inc.; Arena Winch TW1400A.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Manufacturer will construct, fabricate and deliver all materials to jobsite per plans and specifications. All materials will be installed to result in a complete steel frame dasher system with all dashers and spectator shielding to be straight and true to line and properly supported.
- B. The materials shall be delivered to the job site in an enclosed trailer or properly tarped flat deck for protection from road grime. All materials shall be installed under the constant supervision of the manufacturer.
- C. It shall be the responsibility of the manufacturer to visit the site prior to starting fabrications to field measure all areas to ensure proper construction dimensions and details.

END OF SECTION 132000

SECTION 13 3419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Structural-steel framing.
2. Metal roof panels.
3. Foamed-insulation-core metal wall panels.
4. Metal soffit panels.
5. Thermal insulation.
6. Personnel doors and frames.
7. Windows.
8. Accessories.

- B. Related Requirements:

1. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface.
2. Section 083323 "Overhead Coiling Doors" for coiling vehicular doors in metal building systems.
3. Section 083613 "Sectional Doors" for sectional vehicular doors in metal building systems.

1.3 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review methods and procedures related to metal building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.
 - e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
 - b. Structural limitations of purlins and rafters during and after roofing.
 - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - d. Temporary protection requirements for metal roof panel assembly during and after installation.
 - e. Roof observation and repair after metal roof panel installation.
3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - d. Temporary protection requirements for metal wall panel assembly during and after installation.
 - e. Wall observation and repair after metal wall panel installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Metal roof panels.
 - b. Metal wall panels.
 - c. Foamed-insulation-core metal panels.

- d. Metal soffit panels.
- e. Thermal insulation and vapor-retarder facings.
- f. Personnel doors and frames.
- g. Windows.
- h. Translucent roof panels.
- i. Roof ventilators.
- j. Louvers.

B. Sustainable Design Submittals:

1. [<Double click to insert sustainable design text for roofing.>](#)
2. [<Double click to insert sustainable design text for recycled content.>](#)

C. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:

1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
 - b. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and lighting fixtures.
 - c. Show translucent panels.
4. Accessory Drawings: Include details of the following items, at a scale of not less than **1-1/2 inches per 12 inches (1:8)** :
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
 - d. Service walkways.

D. Samples for Initial Selection: For units with factory-applied finishes.

E. Samples for Verification: For the following products:

1. Panels: Nominal **12 inches (300 mm)** long by actual panel width. Include fasteners, closures, and other exposed panel accessories.

2. Flashing and Trim: Nominal 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 3. Vapor-Retarder Facings: Nominal 6-inch- (150-mm-) square Samples.
 4. Windows: Full-size, nominal 12-inch- (300-mm-) long frame Samples showing typical profile.
 5. Accessories: Nominal 12-inch- (300-mm-) long Samples for each type of accessory.
- F. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- G. Delegated-Design Submittal: For metal building systems.
1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector, manufacturer, and land surveyor.
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
1. Name and location of Project.
 2. Order number.
 3. Name of manufacturer.
 4. Name of Contractor.
 5. Building dimensions including width, length, height, and roof slope.
 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 7. Governing building code and year of edition.
 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- D. Erector Certificates: For qualified erector, from manufacturer.

- E. Material Test Reports: For each of the following products:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.
- I. Sample Warranties: For special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.
- E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for typical wall metal panel including accessories.
 - a. Size: 96 inches (2400 mm) long by 96 inches (2400 mm) .
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, 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. Protect foam-plastic insulation as follows:
 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.12 WARRANTY

- A. Special Warranty on Metal Panel Finishes: 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.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
 2. Rigid Modular: Solid-member, structural-framing system with interior columns.
 3. Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.
 4. Truss-Frame Modular: Truss-member, structural-framing system with interior columns.
 5. Lean-to: Solid- or truss-member, structural-framing system, designed to be partially supported by another structure.
- C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of [**primary frame, capable of supporting one-half of a bay design load, and end-wall columns**] [**load-bearing end-wall and corner columns and rafters**].
- D. End-Wall Framing: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.
- E. Secondary-Frame Type: Manufacturer's standard purlins and joists and [**flush-framed**] [**partially inset-framed**] [**exterior-framed (bypass)**] girts.
- F. Eave Height: [**16 feet (4.9 m)**] [**20 feet (6.1 m)**] [**24 feet (7.3 m)**] [**28 feet (8.5 m)**] [**Manufacturer's standard height, as indicated by nominal height on Drawings**] **<Insert dimension>**.

- G. Bay Spacing: [20 feet (6.1 m)] [25 feet (7.6 m)] [30 feet (9.1 m)] [As determined by manufacturer] [As indicated on Drawings] <Insert dimension>.
- H. Roof Slope: [1/4 inch per 12 inches (1:48)] [1/2 inch per 12 inches (1:24)] [1 inch per 12 inches (1:12)] [4 inches per 12 inches (1:3)] [Manufacturer's standard for frame type required] <Insert slope>.
- I. Roof System: Manufacturer's standard [standing-seam, vertical-rib,] [standing-seam, trapezoidal-rib,] [lap-seam, tapered-rib] [foamed-insulation-core] metal roof panels.
 - 1. Liner Panels: Tapered rib.
- J. Exterior Wall System: Manufacturer's standard [exposed-fastener, tapered-rib,] [exposed-fastener, reverse-rib,] [concealed-fastener, flush-profile,] [foamed-insulation-core] metal wall panels.
 - 1. Liner Panels: [Tapered rib] [Flush profile].

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: [As indicated on Drawings] <Insert applicable code requirement>.
 - 2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - 3. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of [1/150] [1/240] [1/360] <Insert limit> of the span.
 - b. Girts: Horizontal deflection of [1/120] [1/180] [1/240] <Insert limit> of the span.
 - c. Metal Roof Panels: Vertical deflection of [1/150] [1/240] [1/360] <Insert limit> of the span.
 - d. Metal Wall Panels: Horizontal deflection of [1/180] [1/240] <Insert limit> of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - f. Lateral Drift: Maximum of [1/60] [1/100] [1/200] [1/400] <Insert limit> of the building height.
- C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.

- D. 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: [120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces] <Insert temperature change>.
- E. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 or ASTM E 108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.
- F. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.
- G. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- H. Structural Performance for Metal Roof[and Wall] Panels: 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.
- I. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 1680[or ASTM E 283] at the following test-pressure difference:
1. Test-Pressure Difference: [1.57 lbf/sq. ft. (75 Pa)] [6.24 lbf/sq. ft. (300 Pa)].
- J. Air Infiltration for Metal Wall Panels: 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: [1.57 lbf/sq. ft. (75 Pa)] [6.24 lbf/sq. ft. (300 Pa)].
- K. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646[or ASTM E 331] at the following test-pressure difference:
1. Test-Pressure Difference: [2.86 lbf/sq. ft. (137 Pa)] [6.24 lbf/sq. ft. (300 Pa)].
- L. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: [**2.86 lbf/sq. ft. (137 Pa)**] [**6.24 lbf/sq. ft. (300 Pa)**].
 - M. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: [**UL 30**] [**UL 60**] [**UL 90**].
 - N. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 1. Fire/Windstorm Classification: Class 1A-**[60]** **[75]** **[90]** **[105]** **[120]** **<Insert number>**.
 2. Hail Resistance: **[MH]** **[SH]**.
 - O. [<Double click to insert sustainable design text for solar reflectance index.>](#)
 - P. Energy Star Listing: Roof panels that are listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for **[low]** **[steep]**-slope roof products.
 - Q. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:
 1. Three-year, aged, solar reflectance of not less than **[0.55]** **<Insert value>** and emissivity of not less than **[0.75]** **<Insert value>**.
 2. Three-year, aged, Solar Reflectance Index of not less than **[64]** **<Insert value>** when calculated according to ASTM E 1980.
 - R. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C 1363 or ASTM C 518:
 1. Roof:
 - a. U-Factor: **<Insert value>**.
 - b. R-Value: 30.
 2. Walls:
 - a. U-Factor: **<Insert value>**.
 - b. R-Value: 13 + 13 continuous.
- 2.4 STRUCTURAL-STEEL FRAMING
- A. [<Double click to insert sustainable design text for recycled content.>](#)
 - B. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
 - C. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

- D. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- E. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 3. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
 4. Truss-Frame, Clear-Span Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 5. Truss-Frame Modular Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
 6. Long-Bay Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
 7. Frame Configuration: [**Single gable**] [**One-directional, sloped**] [**Lean-to, with high side connected to and supported by another structure**] [**Multiple gable**] [**Load-bearing wall**] [**Multistory**].
 8. Exterior Column: [**Uniform depth**] [**Tapered**].
 9. Rafter: [**Uniform depth**] [**Tapered**].
- F. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- G. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum **2-1/2-inch- (64-mm-)** wide flanges.
 - a. Depth: **[As indicated on Drawings] [As needed to comply with system performance requirements] <Insert dimension>**.
 2. Purlins: Steel joists of depths indicated on Drawings.
 3. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum **2-1/2-inch- (64-mm-)** wide flanges.
 - a. Depth: **[As indicated on Drawings] [As required to comply with system performance requirements] <Insert dimension>**.
 4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 5. Flange Bracing: Minimum **2-by-2-by-1/8-inch (51-by-51-by-3-mm)** structural-steel angles or **1-inch- (25-mm-)** diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 6. Sag Bracing: Minimum **1-by-1-by-1/8-inch (25-by-25-by-3-mm)** structural-steel angles.
 7. Base or Sill Angles: Manufacturer's standard base angle, minimum **3-by-2-inch (76-by-51-mm)**, fabricated from zinc-coated (galvanized) steel sheet.
 8. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- H. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
1. Type: **[Straight-beam, eave type] [Purlin-extension type] [Tapered-beam, below-eave type] [As indicated]**.
- I. Bracing: Provide adjustable wind bracing **[using any method]** as follows:
1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade **50 (345)**; or ASTM A 529/A 529M, Grade **50 (345)**; minimum **1/2-inch- (13-mm-)** diameter steel; threaded full length or threaded a minimum of **6 inches (152 mm)** at each end.
 2. Cable: ASTM A 475, minimum **1/4-inch- (6-mm-)** diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
 3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
 4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

5. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
- J. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- K. Materials:
1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).
 2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).
 3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).
 4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
 6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55 (205 through 380), or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70 (310 through 480); or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80 (170 through 550), or HSLAS, Grades 45 through 70 (310 through 480).
 7. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, SS, Grades 33 through 80 (230 through 550), or HSLAS or HSLAS-F, Grades 50 through 80 (340 through 550); with G60 (Z180) coating designation; mill phosphatized.
 8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, SS, Grades 33 through 80 (230 through 550), or HSLAS or HSLAS-F, Grades 50 through 80 (340 through 550); with G90 (Z275) coating designation.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, SS, Grade 50 or 80 (340 or 550); with Class AZ50 (AZM150) coating.
 9. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for primary framing.
 10. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for secondary framing.
 11. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 (ASTM A 563M) carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.

- a. Finish: **[Plain] [Hot-dip zinc coating, ASTM F 2329, Class C] [Mechanically deposited zinc coating, ASTM B 695, Class 50].**
 12. Structural Bolts, Nuts, and Washers: **ASTM A 325 (ASTM A 325M)**, Type 1, heavy-hex steel structural bolts; **ASTM A 563 (ASTM A 563M)** heavy-hex carbon-steel nuts; and **ASTM F 436 (ASTM F 436M)** hardened carbon-steel washers.
 - a. Finish: **[Plain] [Hot-dip zinc coating, ASTM F 2329, Class C] [Mechanically deposited zinc coating, ASTM B 695, Class 50].**
 13. High-Strength Bolts, Nuts, and Washers: **ASTM A 490 (ASTM A 490M)**, Type 1, heavy-hex steel structural bolts[**or tension-control, bolt-nut-washer assemblies with spline ends**]; **ASTM A 563 (ASTM A 563M)** heavy-hex carbon-steel nuts; and **ASTM F 436 (ASTM F 436M)** hardened carbon-steel washers, plain.
 14. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with spline ends.
 - a. Finish: **[Plain] [Mechanically deposited zinc coating, ASTM B 695, Class 50] [Mechanically deposited zinc coating, ASTM B 695, Class 50, baked-epoxy coated].**
 15. Unheaded Anchor Rods: **[ASTM F 1554, Grade 36] [ASTM A 572/A 572M, Grade 50 (345)] [ASTM A 36/A 36M] [ASTM A 307, Grade A].**
 - a. Configuration: Straight.
 - b. Nuts: **ASTM A 563 (ASTM A 563M) [heavy-]**hex carbon steel.
 - c. Plate Washers: ASTM A 36/A 36M carbon steel.
 - d. Washers: **ASTM F 436 (ASTM F 436M)** hardened carbon steel.
 - e. Finish: **[Plain] [Hot-dip zinc coating, ASTM F 2329, Class C] [Mechanically deposited zinc coating, ASTM B 695, Class 50].**
 16. Headed Anchor Rods: **[ASTM F 1554, Grade 36] [ASTM A 307, Grade A].**
 - a. Configuration: Straight.
 - b. Nuts: **ASTM A 563 (ASTM A 563M) [heavy-]**hex carbon steel.
 - c. Plate Washers: ASTM A 36/A 36M carbon steel.
 - d. Washers: **ASTM F 436 (ASTM F 436M)** hardened carbon steel.
 - e. Finish: **[Plain] [Hot-dip zinc coating, ASTM F 2329, Class C] [Mechanically deposited zinc coating, ASTM B 695, Class 50].**
 17. Threaded Rods: **[ASTM A 193/A 193M] [ASTM A 572/A 572M, Grade 50 (345)] [ASTM A 36/A 36M] [ASTM A 307, Grade A].**
 - a. Nuts: **ASTM A 563 (ASTM A 563M) [heavy-]**hex carbon steel.
 - b. Washers: **[ASTM F 436 (ASTM F 436M) hardened] [ASTM A 36/A 36M]** carbon steel.
 - c. Finish: **[Plain] [Hot-dip zinc coating, ASTM F 2329, Class C] [Mechanically deposited zinc coating, ASTM B 695, Class 50].**
- L. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Clean and prepare in accordance with SSPC-SP2.
2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of **1 mil (0.025 mm)**.
 - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of **0.5 mil (0.013 mm)** on each side.

2.5 METAL ROOF PANELS

A. Standing-Seam, Vertical-Rib, Metal Roof Panels <Insert drawing designation>: Formed with vertical ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch (0.46-mm)**] [**0.024-inch (0.61-mm)**] [**0.030-inch (0.76-mm)**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].
 - b. Color: [**As indicated by manufacturer's designations**] [**As selected by Architect from manufacturer's full range**] <Insert color>.
2. Clips: [**One-piece fixed**] [**Two-piece floating**] to accommodate thermal movement.
3. Joint Type: [**Panels snapped together**] [**Mechanically seamed**].
4. Panel Coverage: [**16 inches (406 mm)**] <Insert dimension>.
5. Panel Height: [**2 inches (51 mm)**] <Insert dimension>.

B. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels <Insert drawing designation>: Formed with raised trapezoidal ribs at panel edges and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch (0.46-mm)**] [**0.024-inch (0.61-mm)**] [**0.030-inch (0.76-mm)**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].
 - b. Color: [**As indicated by manufacturer's designations**] [**As selected by Architect from manufacturer's full range**] <Insert color>.
2. Clips: [**One-piece fixed**] [**Two-piece floating**] to accommodate thermal movement.
3. Joint Type: [**Panels snapped together**] [**Mechanically seamed**].
4. Panel Coverage: [**24 inches (610 mm)**] <Insert dimension>.

5. Panel Height: **[3 inches (76 mm)]** <Insert dimension>.
 6. Uplift Rating: **[UL 30]** **[UL 60]** **[UL 90]**.
- C. Exposed Fastener, Tapered-Rib, Metal Roof Panels <Insert drawing designation>: Formed with raised, trapezoidal major ribs and **[intermediate stiffening ribs symmetrically spaced]** **[flat pan]** between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **[0.018-inch (0.46-mm)]** **[0.024-inch (0.61-mm)]** **[0.030-inch (0.76-mm)]** nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: **[Two-coat fluoropolymer]** **[Three-coat fluoropolymer]** **[Siliconized polyester]**.
 - b. Color: **[As indicated by manufacturer's designations]** **[As selected by Architect from manufacturer's full range]** <Insert color>.
 2. Major-Rib Spacing: **[6 inches (152 mm)]** **[12 inches (305 mm)]** <Insert dimension> o.c.
 3. Panel Coverage: **[36 inches (914 mm)]** <Insert dimension>.
 4. Panel Height: **[0.75 inch (19 mm)]** **[1.125 inches (29 mm)]** **[1.188 inches (30 mm)]** **[1.25 inches (32 mm)]** **[1.5 inches (38 mm)]** <Insert dimension>.
- D. Exposed-Fastener, Tapered-Rib, Metal Liner Panels <Insert drawing designation>: Formed with raised, trapezoidal major ribs and **[intermediate stiffening ribs symmetrically spaced]** **[flat pan]** between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **[0.018-inch (0.46-mm)]** **[0.024-inch (0.61-mm)]** **[0.030-inch (0.76-mm)]** nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: **[Two-coat fluoropolymer]** **[Three-coat fluoropolymer]** **[Siliconized polyester]**.
 - b. Color: **[As indicated by manufacturer's designations]** **[As selected by Architect from manufacturer's full range]** <Insert color>.
 2. Major-Rib Spacing: **[6 inches (152 mm)]** **[12 inches (305 mm)]** <Insert dimension> o.c.
 3. Panel Coverage: **[36 inches (914 mm)]** <Insert dimension>.
 4. Panel Height: **[1.25 inches (32 mm)]** **[1.5 inches (38 mm)]** <Insert dimension>.
- E. Finishes:
1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. 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.
- b. 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.
 - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.

2.6 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels **<Insert drawing designation>**: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
1. Panel Thermal-Resistance Value (R-Value): **<Insert R-value>**.
 2. Facing Material: Fabricate panel with exterior and interior facings of same material and thickness. Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch (0.46-mm)**] [**0.024-inch (0.61-mm)**] [**0.030-inch (0.76-mm)**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Surface: [**Smooth, flat**] [**Striated**] [**Shallow ribs**] [**Shallow V grooves**].
 - b. Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].
 - c. Color: [**As indicated by manufacturer's designations**] [**As selected by Architect from manufacturer's full range**] **<Insert color>**.
 3. Panel Coverage: [**36 inches (914 mm)**] [**42 inches (1067 mm)**] **<Insert dimension>** nominal.
 4. Panel Thickness: [**2 inches (51 mm)**] [**2.5 inches (64 mm)**] [**3 inches (76 mm)**] [**4 inches (102 mm)**] [**5 inches (127 mm)**] [**6 inches (152 mm)**] **<Insert dimension>**.
 5. Insulation Core: Modified polyisocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place or board type, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
 - b. Density: **2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m)** when tested according to ASTM D 1622.
 - c. Compressive Strength: Minimum **20 psi (140 kPa)** when tested according to ASTM D 1621.
 - d. Shear Strength: **26 psi (179 kPa)** when tested according to ASTM C 273/C 273M.

6. Fire-Test-Response Characteristics: Class A according to ASTM E 108.
7. Surface-Burning Characteristics: Flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

B. Finishes:

1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. 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.
 - b. 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.
 - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.

2.7 METAL SOFFIT PANELS

- A. General: Provide factory-formed 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[**and factory-applied sealant**] in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels: Match profile and material of metal [**roof**] [**wall**] panels.
 1. Finish: [**Match finish and color of metal roof panels**] [**Match finish and color of metal wall panels**] [**As indicated on Drawings**].
- C. Exposed-Fastener, Tapered-Rib-Profile, Metal Soffit Panels <**Insert drawing designation**>: Formed with raised, trapezoidal major ribs and [**intermediate stiffening ribs symmetrically spaced**] [**flat pan**] between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch (0.46-mm)**] [**0.024-inch (0.61-mm)**] [**0.030-inch (0.76-mm)**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [**Two-coat fluoropolymer**] [**Three-coat fluoropolymer**] [**Siliconized polyester**].

- b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Major-Rib Spacing: [6 inches (152 mm)] [12 inches (305 mm)] <Insert dimension> o.c.
 3. Panel Coverage: [36 inches (914 mm)] <Insert dimension>.
 4. Panel Height: [0.75 inch (19 mm)] [1.125 inches (29 mm)] [1.188 inches (30 mm)] [1.25 inches (32 mm)] [1.5 inches (38 mm)] <Insert dimension>.
- D. Concealed-Fastener, Flush-Profile, Metal Soffit Panels <Insert drawing designation>: Formed with vertical panel edges and [a single wide recess, centered between panel edges] [flush surface]; with flush joint between panels; with 1-inch- (25-mm-) wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners[and factory-applied sealant] in side laps.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.024-inch (0.61-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: [Fluoropolymer] [Siliconized polyester].
 - b. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.
 2. Panel Coverage: [12 inches (305 mm)] [16 inches (406 mm)] <Insert dimension>.
 3. Panel Height: [1 inch (25 mm)] [1.5 inches (38 mm)] <Insert dimension>.

2.8 THERMAL INSULATION

- A. Faced Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- B. Unfaced Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- C. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.
 1. Nonreflective Faced: Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 2. Reflective Faced: Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 3. Unfaced: Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.

- D. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (foil facing), Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core. Provide units tested for interior exposure without an approved thermal barrier.
- E. Retainer Strips: For securing insulation between supports, 0.025-inch (0.64-mm) nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.
- F. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M, Desiccant Method.
 - 1. Composition: White metallized-polypropylene film facing, fiberglass scrim reinforcement, and kraft-paper backing.
 - 2. Composition: Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.
 - 3. Composition: White [polypropylene] [vinyl] film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.
 - 4. Composition: White polypropylene film facing and fiberglass-polyester-blend fabric backing.
- G. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.9 PERSONNEL DOORS AND FRAMES

- A. Swinging Personnel Doors and Frames: As specified in Section 081113 "Hollow Metal Doors and Frames."
- B. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.
 - 1. Steel Doors: 1-3/4 inches (44.5 mm) thick; fabricated from metallic-coated steel face sheets, 0.036-inch (0.91-mm) nominal uncoated steel thickness, of [seamed] [seamless], hollow-metal construction; with 0.060-inch (1.52-mm) nominal uncoated steel thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.
 - a. Design: [Flush panel] [As indicated on Drawings] <Insert design>.
 - b. Core: Kraft honeycomb with U-factor rating of at least 0.47 Btu/sq. ft. x h x deg F (2.67 W/sq. m x K).
 - c. Core: Polystyrene foam with U-factor rating of at least 0.16 Btu/sq. ft. x h x deg F (0.91 W/sq. m x K).
 - d. Core: Polyurethane foam with U-factor rating of at least 0.07 Btu/sq. ft. x h x deg F (0.40 W/sq. m x K).
 - e. Glazing Frames: Steel frames to receive field-installed glass.
 - f. Glazing: As specified in Section 088000 "Glazing."

2. Steel Frames: Fabricate **2-inch- (51-mm-)** wide face frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.060-inch (1.52-mm)** nominal uncoated steel thickness.
 - a. Type: [**Knocked down for field assembly**] [**Factory welded**].
 3. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.
 4. Hardware:
 - a. Provide hardware for each door leaf, as follows:
 - 1) Hinges: BHMA A156.1. Three [**plain**] [**antifriction**]-bearing, standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; **4-1/2 by 4-1/2 inches (114 by 114 mm)**, with nonremovable pin.
 - 2) Lockset: BHMA A156.2. [**Key-in-lever cylindrical**] [**Mortise, with lever handle**] type.
 - 3) Exit Device: BHMA A156.3. Touch- or push-bar type.
 - 4) Threshold: BHMA A156.21. Extruded aluminum.
 - 5) Silencers: Pneumatic rubber; three silencers on strike jambs of single door frames and two silencers on heads of double door frames.
 - 6) Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.
 - 7) Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.
 - b. Provide each pair of double doors with the following hardware in addition to that specified for each leaf:
 - 1) Astragal: Removable type.
 - 2) Surface Bolts: Top and bottom of inactive door.
 5. Anchors and Accessories: Manufacturer's standard units, galvanized according to ASTM A 123/A 123M.
 6. Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.
- C. Materials:
1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B; free of scale, pitting, or surface defects; pickled and oiled.
 3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS, Type B; with **G60 (Z180)** zinc (galvanized) or **A60 (ZF180)** zinc-iron-alloy (galvannealed) coating designation.
- D. Finishes for Personnel Doors and Frames:
1. Prime Finish: Factory-apply manufacturer's standard primer immediately after cleaning and pretreating.

- a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Factory-Applied Paint Finish: Manufacturer's standard, complying with SDI A250.3 for performance and acceptance criteria.
 - a. Color and Gloss: **[As indicated by manufacturer's designations]** **[Match Architect's sample]** **[As selected by Architect from manufacturer's full range]** **<Insert color and gloss>**.

2.10 WINDOWS

- A. Aluminum Windows: As specified in Section 085113 "Aluminum Windows."
- B. Aluminum Windows: Metal building system manufacturer's standard, with self-flashing mounting fins, and as follows:
 1. Type, Performance Class, and Performance Grade: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 and as follows:
 - a. Horizontal-Sliding Units: **[HS-LC25]** **[HS-CW30]** **<Insert designation>**.
 - b. Single-Hung Units: **[H-LC25]** **[H-CW30]** **<Insert designation>**.
 - c. Fixed Units: **[FW-LC25]** **[FW-CW30]** **[FW-AW40]** **<Insert designation>**.
 2. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than **0.064-inch (1.63-mm)** thickness at any location for main frame and sash members.
 - a. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
 3. Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.
 4. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.
 - a. Reinforcement: Where fasteners screw-anchor into aluminum less than **0.128 inch (3.26 mm)** thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.
 5. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:

- a. Cam-action sweep sash lock and keeper at meeting rails.
 - b. Spring-loaded, snap-type lock at jambs.
 - c. Pole-operated, cam-action locking device on meeting rail where rail is more than **72 inches (1830 mm)** above floor.
 - d. Lift handles for single-hung units.
 - e. Nylon sash rollers for horizontal-sliding units.
 - f. Steel or bronze operating arms.
6. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 701/702.
 7. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, and as follows:
 - a. Aluminum Wire Fabric: **18-by-18 (1.1-by-1.1-mm)**, **18-by-16 (1.1-by-1.3-mm)**, or **18-by-14 (1.1-by-1.5-mm)** mesh of **0.013-inch- (0.3-mm-)** diameter, coated aluminum wire; complying with FS RR-W-365, Type VII.
 - b. Glass-Fiber Mesh Fabric: **18-by-16 (1.1-by-1.3-mm)** or **18-by-14 (1.1-by-1.5-mm)** mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D 3656.
 - c. Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.
- C. Glazing: Comply with requirements specified in Section 088000 "Glazing."
- D. Glazing:
1. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear), 3 mm thick.
 2. Heat-Treated Float Glass: ASTM C 1048, Type I, Quality-Q3, Class I (clear), Condition A, 3 mm thick.
 3. Tinted Float Glass: ASTM C 1036, Type I, Quality-Q3, Class 2, 3 mm thick.
 - a. Tint Color: **[Blue] [Blue-green] [Bronze] [Green] [Gray] [Manufacturer's standard color] <Insert color>**.
 4. Patterned Glass: ASTM C 1036, Type II, Quality-Q6, Class 1 (clear), Form 3, Pattern P3 (random), 3 mm thick.
 5. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of 2.5-mm-thick clear float glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 6. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
 - a. Provide safety glazing labeling.
 7. Glazing Stops: Screw-applied or snap-on glazing stops coordinated with Section 088000 "Glazing" and with glazing system indicated. Match material and finish of window frames.
 8. Factory-Glazed Fabrication: Glaze window units in the factory to greatest extent possible and practical for applications indicated. Comply with requirements in Section 088000 "Glazing."
- E. Finish:

1. Mill finish.
2. Baked-Enamel Finish, Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 0.7 mil (0.02 mm), medium gloss.
 - a. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.

2.11 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 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.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 2. Clips: Manufacturer's standard, formed from [steel] [stainless-steel] sheet, designed to withstand negative-load requirements.
 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from [steel] [stainless-steel sheet or nylon-coated aluminum] sheet.
 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 5. 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 roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch (25-mm) standoff; fabricated from extruded polystyrene.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall 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 wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.018-inch (0.46-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **[0.018-inch (0.46-mm)] [0.030-inch (0.76-mm)]** nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.018-inch (0.46-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum **96-inch- (2438-mm-)** long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.018-inch (0.46-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum **10-foot- (3-m-)** long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Service Walkways: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.048-inch (1.21-mm)** nominal uncoated steel thickness, steel plank grating; with slip-resistant pattern; **[18-inch (457-mm)] [24-inch (610-mm)] [36-inch (914-mm)]** overall width. Support walkways on framing system anchored to metal roof panels without penetrating panels; with predrilled holes and clamps or hooks for anchoring.
- H. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
1. Circular-Revolving Type: Minimum **[20-inch- (508-mm-)]** **<Insert dimension>** diameter throat opening; zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.024-inch (0.61-mm)** nominal uncoated steel thickness, with coil coating; finished to match metal roof panels; with matching base and rain cap.
 - a. Type: **[Directional]** **[Stationary]** revolving.
 - b. Bird Screening: Galvanized steel, **1/2-inch- (13-mm-)** square mesh, **0.041-inch (1.04-mm)** wire; or aluminum, **1/2-inch- (13-mm-)** square mesh, **0.063-inch (1.6-mm)** wire.

- c. Dampers: Spring-loaded, butterfly type; pull-chain operation; with pull chain of length required to reach within **36 inches (914 mm)** of floor.
 - d. Reinforce and brace units, with joints properly formed and edges beaded to be watertight under normal positive-pressure conditions.
 - e. Mount ventilators on square-to-round bases for ridge or on-slope mounting, designed to match roof pitch and roll formed to match metal roof panel profile.
2. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.018-inch (0.46-mm)** nominal uncoated steel thickness, prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum **10-foot- (3-m-)** long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
- a. Bird Screening: Galvanized steel, **1/2-inch- (13-mm-)** square mesh, **0.041-inch (1.04-mm)** wire; or aluminum, **1/2-inch- (13-mm-)** square mesh, **0.063-inch (1.6-mm)** wire.
 - b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within **36 inches (914 mm)** of floor.
 - c. Throat Size: [**9 inches (229 mm)**] [or] [**12 inches (305 mm)**], [as standard with manufacturer, and as required to comply with ventilation requirements].
- I. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.048-inch (1.21-mm)** nominal uncoated steel thickness; finished to match metal wall panels. Form blades from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.036-inch (0.91-mm)** nominal uncoated steel thickness; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.
1. Blades: Fixed.
 2. Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.
 3. Free Area: Not less than [**7.0 sq. ft. (0.65 sq. m)**] <Insert dimension> for **48-inch- (1220-mm-)** wide by **48-inch- (1220-mm-)** high louver.
 4. Bird Screening: Galvanized steel, **1/2-inch- (13-mm-)** square mesh, **0.041-inch (1.04-mm)** wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.
 - a. Mounting: [**Interior**] [**Exterior**] face of louvers.
 5. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or **72 inches (1830 mm)** o.c., whichever is less.
- J. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.048-inch (1.21-mm)** nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.

1. Curb Subframing: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.060-inch (1.52-mm)** nominal uncoated steel thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
 2. Insulation: **1-inch- (25-mm-)** thick, rigid type.
- K. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- L. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
 - b. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
 - c. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws[, **with EPDM sealing washers bearing on weather side of metal panels**].
 - d. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head[, **with EPDM sealing washers bearing on weather side of metal panels**].
 - e. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - f. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 2. Corrosion-Resistant 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.
 3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
 4. Metal Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - b. Joint Sealant: ASTM C 920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.12 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
1. Make shop connections by welding or by using non-high-strength bolts.
 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.13 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

- a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Steel Joists[**and Joist Girders**]: Install joists[, **girders,**] and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
 2. Space, adjust, and align joists accurately in location before permanently fastening.
 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 4. Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
 5. Joist Installation: Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
 6. Joist Installation: Weld joist seats to supporting steel framework.
 7. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - 1. Tighten rod and cable bracing to avoid sag.
 - 2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

- A. 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. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate metal panel splices over structural supports with end laps in alignment.
 - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge[**and hip**] caps as metal roof panel work proceeds.
 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
 6. Provide metal closures at [**peaks**] [**rake edges**] [**rake walls**] [**and**] each side of ridge[**and hip**] caps.
- C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.

1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 4. At metal panel splices, nest panels with minimum **6-inch (152-mm)** end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels **4 inches (102 mm)** minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
- C. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum **42 inches**

(1067 mm) o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.

1. Install clips to supports with self-tapping fasteners.
 2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.
- D. Installation Tolerances: Shim and align metal wall panels within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)**, noncumulative; level, plumb, and on location lines; and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.7 TRANSLUCENT PANEL INSTALLATION

- A. Translucent Panels: Attach translucent panels to structural framing with fasteners according to manufacturer's written instructions. Install panels perpendicular to supports unless otherwise indicated. Anchor translucent panels securely in place, with provisions for thermal and structural movement.
1. Provide end laps of not less than **6 inches (152 mm)** and side laps of not less than **1-1/2-inch (38-mm)** corrugations for metal roof panels.
 2. Provide end laps of not less than **4 inches (102 mm)** and side laps of not less than **1-1/2-inch (38-mm)** corrugations for metal wall panels.
 3. Align horizontal laps with adjacent metal panels.
 4. Seal intermediate end laps and side laps of translucent panels with translucent mastic.

3.8 METAL SOFFIT PANEL INSTALLATION

- A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
- B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.9 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
 2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
 3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
 4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

- B. Blanket Roof Insulation: Comply with the following installation method:
1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
 2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
 3. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
 2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.
- D. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.10 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
 - 1. Between Doors and Frames at Jambs and Head: 1/8 inch (3 mm).
 - 2. Between Edges of Pairs of Doors: 1/8 inch (3 mm).
 - 3. At Door Sills with Threshold: 3/8 inch (9.5 mm).
 - 4. At Door Sills without Threshold: 3/4 inch (19.1 mm).
 - 5. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.
- C. Sliding Service Doors: Bolt support angles to opening head members through factory-punched holes. Bolt door tracks to support angles at maximum 24 inches (610 mm) o.c. Set doors and operating equipment with necessary hardware, jamb and head mold stops, continuous hood flashing, anchors, inserts, hangers, and equipment supports.
- D. Field Glazing: Comply with installation requirements in Section 088000 "Glazing."
- E. Door Hardware:
 - 1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - 4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 079200 "Joint Sealants."

3.11 WINDOW INSTALLATION

- A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.
 - 1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Set sill members in bed of sealant or with gaskets, for weathertight construction.

- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Mount screens directly to frames with tapped screw clips.

3.12 ACCESSORY INSTALLATION

- A. General: 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 roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. 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. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 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 (600 mm)** of corner or intersection. Where lapped or bayonet-type 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).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than **36 inches (914 mm)** o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with **1-1/2-inch (38-mm)** 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.
 - 2. Tie downspouts to underground drainage system indicated.

- E. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.
- F. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.
- G. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
 - 1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 - 2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
 - 3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
 - 4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.
- H. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.13 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.14 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.
- C. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and at weather stripping to ensure smooth operation and weathertight closure. Lubricate hardware and moving parts.

- D. **[Roof Ventilators] [and] [Adjustable Louvers]:** After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily, free of warp, twist, or distortion as needed to provide fully functioning units.
1. Adjust louver blades to be weathertight when in closed position.

3.15 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing[, **bearing plates,**] and accessories.
1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- F. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
1. Immediately before final inspection, remove protective wrappings from doors and frames.
- G. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.
- H. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

- a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 133419

SECTION 14 2400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hydraulic passenger elevators.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
 - 2. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
 - 3. Section 042000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
 - 4. Section 051200 "Structural Steel Framing" for the following:
 - a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - b. Divider beams.
 - c. Hoist beams.
 - d. Structural-steel shapes for subsills that are part of steel frame.
 - 5. Section 055000 "Metal Fabrications" for the following:
 - a. Attachment plates and angle brackets for supporting guide-rail brackets.
 - b. Hoist beams.
 - c. Structural-steel shapes for subsills.
 - d. Pit ladder.
 - e. Cants in hoistways made from steel sheet.
 - 6. Section 221429 "Sump Pumps" for sump pumps, sumps, and sump covers in elevator pits.
 - 7. Section 271500 "Communications Horizontal Cabling" for telephone service for elevators.
 - 8. Section 283111 "Digital, Addressable Fire-Alarm System" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.
 - 9. Section 31200 "Earth Moving" for excavating well hole to accommodate cylinder assembly.

1.3 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- B. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Include large-scale layout of car-control station and standby power operation control panel.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
- C. Samples for Initial Selection: For finishes involving color selection.
- D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; **3-inch (75-mm-)** square Samples of sheet materials; and **4-inch (100-mm)** lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service including standby power generator, as shown and specified, are adequate for elevator system being provided.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
- D. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in same form as, "Draft of Elevator Maintenance Agreement" at end of this Section, starting on date initial maintenance service is concluded.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Furnish well casing and coordinate delivery with related excavation work.
- C. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 2. Warranty Period: five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Source Limitations: Obtain elevators from single manufacturer.
1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator safety requirements for seismic risk Zone 2 or greater in ASME A17.1/CSA B44.
1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
 2. Affected peak velocity acceleration (A_v) for Project's location is [**less than 0.10 (seismic risk Zones 0 and 1)**] [**greater than or equal to 0.10, but less than 0.20 (seismic risk Zone 2)**] [**greater than or equal to 0.20 (seismic risk Zones 3 and 4)**].
 3. Provide earthquake equipment required by ASME A17.1/CSA B44.
 4. Provide seismic switch required by ASCE/SEI 7.
 5. Design earthquake spectral response acceleration short period (S_d s) for Project is **<Insert value>**.
 6. Project's Seismic Design Category: [**A**] [**B**] [**C**] [**D**] [**E**] [**F**].
 7. Elevator Component Importance Factor: [**1.5**] [**1.0**].

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
1. Elevator Number(s): <Insert elevator number(s) as shown on Drawings>.
 2. Type: Under-the-car single cylinder.
 3. Rated Load: **3500 lb (1589 kg)** .
 4. Rated Speed: **125 fpm (0.64 m/s)** .
 5. Operation System: Single automatic .
 6. Auxiliary Operations:
 - a. Standby power operation.
 7. Car Enclosures:
 - a. Inside Width: [**64 inches (1626 mm)**] [**68 inches (1727 mm)**] [**80 inches (2032 mm)**] [**92 inches (2337 mm)**] <Insert dimension> from side wall to side wall.
 - b. Inside Depth: [**51 inches (1295 mm)**] [**53 inches (1346 mm)**] [**57 inches (1448 mm)**] [**65 inches (1651 mm)**] [**87-1/2 inches (2222 mm)**] [**90 inches (2286 mm)**] [**93 inches (2362 mm)**] [**93-1/2 inches (2375 mm)**] [**96 inches (2438 mm)**] [**101 inches (2565 mm)**] [**102 inches (2591 mm)**] <Insert dimension> from back wall to front wall (return panels).
 - c. Inside Height: [**88 inches (2235 mm)**] [**92 inches (2337 mm)**] [**94 inches (2388 mm)**] [**100 inches (2540 mm)**] [**104 inches (2642 mm)**] [**108 inches (2743 mm)**] [**112 inches (2845 mm)**] <Insert dimension> to underside of ceiling.
 - d. Front Walls (Return Panels): [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**] with integral car door frames.
 - e. Car Fixtures: [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**].
 - f. Side and Rear Wall Panels: [**Enameled steel**] [**Plastic laminate**] [**Satin stainless steel, No. 4 finish**] [**Textured stainless steel**] [**Satin bronze, lacquered**].
 - g. Reveals: [**Enameled steel**] [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**].
 - h. Door Faces (Interior): [**Enameled steel**] [**Primed steel**] [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Textured stainless steel**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**] [**Plastic laminate**].
 - i. Door Sills: [**Aluminum, mill finish**] [**Bronze, polished**] [**Nickel silver, polished**].
 - j. Ceiling: [**Luminous ceiling**] [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Polished bronze, lacquered**] [**Reflective metallic-finish, plastic-laminate, stainless steel**] [**Reflective metallic-finish, plastic-laminate, bronze**].
 - k. Handrails: [**1-1/2 inches (38 mm) round**] [**1/2 by 2 inches (13 by 50 mm) rectangular**] <Insert dimension(s)> [**mirror-polished stainless steel, No. 8 finish**] [**satin stainless steel, No. 4 finish**] [**mirror-polished bronze, lacquered**] [**satin bronze, lacquered**], at [**sides**] [**and**] [**rear**] of car.
 - l. Floor: Manufacturer's standard carpet.

- m. Floor prepared to receive carpet (specified in Section 096816 "Sheet Carpeting").
 - n. Floor prepared to receive resilient flooring (specified in Section 096500 "Resilient Flooring").
 - o. Floor recessed and prepared to receive [**dimension stone tile (specified in Section 093033 "Stone Tiling")**] [**ceramic tile (specified in Section 093013 "Ceramic Tiling")**].
 - p. Floor Thickness, Including Setting Materials: <Insert thickness> above plywood subfloor.
8. Hoistway Entrances:
- a. Width: [**36 inches (914 mm)**] [**42 inches (1067 mm)**] [**48 inches (1219 mm)**] [**54 inches (1372 mm)**] <Insert dimension>.
 - b. Height: [**84 inches (2134 mm)**] [**96 inches (2438 mm)**] <Insert dimension>.
 - c. Type: [**Single-speed side sliding**] [**Two-speed side sliding**] [**Single-speed center opening**] [**Two-speed center opening**].
 - d. Frames [**at First Floor**] [**at Basement Floors**]: [**Enameled steel**] [**Primed steel**] [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**].
 - e. Frames at Other Floors: [**Enameled steel**] [**Primed steel**] [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**].
 - f. Doors[**and Transoms**] [**at First Floor**] [**at Basement Floors**]: [**Enameled steel**] [**Primed steel**] [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Textured stainless steel**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**] [**Plastic laminate**].
 - g. Doors[**and Transoms**] at Other Floors: [**Enameled steel**] [**Primed steel**] [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Textured stainless steel**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**] [**Plastic laminate**].
 - h. Sills [**at First Floor**] [**at Basement Floors**]: [**Aluminum, mill finish**] [**Bronze, polished**] [**Nickel silver, polished**].
 - i. Sills at Other Floors: [**Aluminum, mill finish**] [**Bronze, polished**] [**Nickel silver, polished**].
9. Hall Fixtures [**at First Floor**] [**at Basement Floors**]: [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**] [**Recessed type with no exposed-metal surfaces**].
10. Hall Fixtures at Other Floors: [**Polished stainless steel, No. 8 finish**] [**Satin stainless steel, No. 4 finish**] [**Polished bronze, lacquered**] [**Satin bronze, lacquered**] [**Recessed type with no exposed-metal surfaces**].
11. Additional Requirements:
- a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from [**polished stainless steel, No. 8 finish**] [**satin stainless steel, No. 4 finish**] [**polished bronze, lacquered**] [**satin bronze, lacquered**].
 - b. Provide hooks for protective pads[**in all cars**] and [**one**] [**two**] <Insert number> complete set(s) of full-height protective pads.

2.4 SYSTEMS AND COMPONENTS

- A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts or shall be tank-top-mounted type with fan-cooled, squirrel-cage induction motor, and shall be mounted on oil tank with vibration isolation mounts and enclosed in prime-painted steel enclosure lined with **1-inch (25-mm)** thick, glass-fiber insulation board.
 2. Motor shall have wye-delta or solid-state starting.
 3. Motor shall have variable-voltage, variable-frequency control.
- B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.
- C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
1. Cylinder units shall be connected with dielectric couplings.
 2. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.
- D. Hydraulic Fluid: Elevator manufacturer's standard fire-resistant fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- F. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1/CSA B44, of sufficient size to provide not less than **1-inch (25-mm)** clearance from cylinder and extending above pit floor. Casing shall have means of monitoring effectiveness to comply with ASME A17.1/CSA B44.
- G. Corrosion-Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler shall be electrically nonconductive, displace or absorb water, and gel or solidify at temperatures below **60 deg F (16 deg C)**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- H. Car Frame and Platform: Welded steel units.
- I. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.
- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
1. Single-Car Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at [**main lobby**] [**fire command station**] <**Insert location**>. Manual operation causes automatic operation to cease.
 2. Single-Car Standby-Powered Lowering: On activation of standby power, if car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to a preselected floor, opens its doors, and shuts down. If car is below the preselected floor, it is lowered to the next lower floor, opens its doors, and shuts down.
 3. Single-Car Standby-Powered Lowering: On activation of standby power, car is lowered to the lowest floor, opens its doors, and shuts down.
 4. Single-Car Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to a preselected floor, opens its doors, and shuts down. If car is below the preselected floor, it is lowered to the next lower floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 5. Single-Car Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 6. Group Standby Power Operation: On activation of standby power, cars are returned to a designated floor and parked with doors open. Only one car is moved upward at a time, with priority given to loaded cars. If a car cannot be returned after two attempts, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within 60 seconds, the system removes car from service and places another car in service. Cars can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at [**main lobby**] [**fire command station**] <**Insert location**>. Manual operation causes automatic operation to cease.
 7. Group Standby Power Operation: On activation of standby power, cars are returned to lowest floor and parked with doors open. If a car cannot be returned, it is removed from the system. One car is selected for service on standby power by a switch located at [**main lobby**] [**fire command station**] <**Insert location**>.
 8. Group Standby-Powered Lowering: On activation of standby power, cars that are at a floor remain at that floor, open their doors, and shut down. Cars that are between floors are lowered to a preselected floor, open their doors, and shut down. Cars that are below the preselected floor are lowered to the next lower floor, open their doors, and shut down.
 9. Group Standby-Powered Lowering: On activation of standby power, cars are lowered to the lowest floor, open their doors, and shut down.
 10. Group Battery-Powered Lowering: If power fails, cars that are at a floor remain at that floor, open their doors, and shut down. Cars that are between floors are lowered to a preselected floor, open their doors, and shut down. Cars that are below the preselected

floor are lowered to the next lower floor, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.

11. Group Battery-Powered Lowering: When power fails, cars are lowered to the lowest floor, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.
12. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors start closing.
13. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls[**and predetermined weight**] can be adjusted.
14. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car responds only to car calls, not to hall calls.
15. Independent Service: Keyswitch in car-control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. General: Provide enameled-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 1. Subfloor: Exterior, C-C Plugged grade plywood, not less than **7/8-inch (22.2-mm)** nominal thickness.
 2. Floor Finish: Specified in <Insert Section number>-<Insert Section title> .
 3. Enameled-Steel Wall Panels: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
 4. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 5. Fabricate car with recesses and cutouts for signal equipment.
 6. Fabricate car door frame integrally with front wall of car.

7. Enameled-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
8. Sills: Extruded metal, with grooved surface, **1/4 inch (6.4 mm)** thick.
9. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 1. Enameled-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
 2. Primed-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied, rust-resistant primer for field painting.
 3. Steel Subframes: Formed from cold- or hot-rolled steel sheet, with factory-applied enamel finish or rust-resistant primer. Fabricate to receive applied finish as indicated.
 4. Stainless-Steel Frames: Formed from stainless-steel sheet.
 5. Bronze Frames: Formed from cold- or hot-rolled steel sheet, with enamel finish, and with formed-bronze sheet laminated to steel frames using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 6. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than **3 inches (76 mm)** high, on both inside surfaces of hoistway door frames.
 7. Enameled-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
 8. Sills: Extruded metal, with grooved surface, **1/4 inch (6.4 mm)** thick.
 9. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with **[long-life lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers]** [or] **[LEDs]**.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Swing-Return Car-Control Stations: Provide car-control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.
1. Mark buttons and switches for function. Use both tactile symbols and Braille.
 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- D. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- E. Firefighters' Two-Way Telephone Communication Service: Provide **[flush-mounted cabinet]** **[telephone jack]** in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in **[Section 283111 "Digital, Addressable Fire-Alarm System"]** **[Section 283112 "Zoned (DC Loop) Fire-Alarm System."]**
- F. Car Position Indicator: Provide **[illuminated,]**digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- G. Hall Push-Button Stations: **[Provide one hall push-button station at each landing]** **[Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group]** **[Provide hall push-button station at each landing as indicated].**
1. Provide **[manufacturer's standard wall-mounted units]****[units with flat faceplate for mounting with body of unit recessed in wall].**
 2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
 3. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in **[Section 283111 "Digital, Addressable Fire-Alarm System"]**

[Section 283112 "Zoned (DC Loop) Fire-Alarm System."]Possibly insert a provision for either an "In Use" signal or a digital display of car position for single elevators.

- H. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide **[one of]** the following:
1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
 2. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
 3. Units mounted in both jambs of entrance frame **[for each elevator]**.
 4. Units mounted in both car door jambs **[; may be used only for single elevators or for two-car groups]**.
- I. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
1. At manufacturer's option, audible signals may be placed on cars.
- J. Hall Position Indicators: Provide **[illuminated,]** digital-display-type position indicators, located above **[each]** hoistway entrance at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
1. Integrate ground-floor hall lanterns with hall position indicators.
- K. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. **[For each elevator, provide illuminated signals that indicate when they are operational and when they are at the designated emergency return level with doors open.]**
- L. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.
- M. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.
- 2.10 FINISH MATERIALS
- A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- E. Textured Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 with embossed texture rolled into exposed surface.
- F. Stainless-Steel Bars: ASTM A 276, Type 304.
- G. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- H. Bronze Plate and Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal).
- I. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
- J. Bronze Tubing: **ASTM B 135 (ASTM B 135M)**, Alloy UNS No. C23000 (red brass, 85 percent copper).
- K. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, Alloy 6063.
- L. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Excavation for Cylinder: Drill well hole in elevator pit to accommodate installation of cylinder; comply with applicable requirements in Section 312000 "Earth Moving."
- B. Provide waterproof well casing as necessary to retain well-hole walls.
- C. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole and provide permanent waterproof seal at bottom of well casing.
 - 1. Fill void space between protective casing and cylinder with corrosion-protective filler.

2. Align cylinders and fill space around protective casing with fine sand.
- D. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between well casing and pit floor with **4 inches (100 mm)** of nonshrink, nonmetallic grout.
- E. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- F. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- G. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- H. Install piping above the floor, where possible. Install underground piping in casing.
- I. Lubricate operating parts of systems as recommended by manufacturers.
- J. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- K. Leveling Tolerance: **1/4 inch (6 mm)**, up or down, regardless of load and travel direction.
- L. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- M. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 2. Place hall lanterns either above or beside each hoistway entrance.
 3. Mount hall lanterns at a minimum of **72 inches (1829 mm)** above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for elevator used for construction purposes:
1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 2. Provide strippable protective film on entrance and car doors and frames.
 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 5. Do not load elevators beyond their rated weight capacity.
 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include <Insert number> months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
1. Perform maintenance during normal working hours.
 2. Perform emergency callback service during normal working hours with response time of [two] <Insert number> hours or less.
 3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of [two] <Insert number> hours or less.

END OF SECTION 142400