C-17 Corrosion Control / Fuel Cell Hangar Project
Douglas International Airport - Charlotte, North Carolina

B-3 Final Design Submission

SPECIFICATIONS

22 September 2017

Contract Number: W9133L-15-D-0002
Task Order Number: D303
PN: FJRP159062
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NOT APPLICABLE

*Facility Services Subgroup*

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A. Section Includes:

2. Work under separate contracts.
4. Access to site.
5. Work restrictions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Government's facilities.

1.2 PROJECT INFORMATION

A. Project Identification:

1. Project Location: C-17 Corrosion Control / Fuel Cell Hangar and Flight Simulator Training Facility (SIM), Charlotte-Douglas IAP Air National Guard Base, Charlotte, North Carolina

B. Owner: North Carolina Air National Guard (NCANG)

C. LEED Criteria: The Project has been designed to comply with a Silver Certification Level (minimum) according to the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) Rating System Version 2009 in a certification process with the United States Green Building Counsel (USGBC). This process requires efforts by the General Contractor (GC) and his subcontractors, the GC’s Independent Commissioning Agent (CxA), the Design A/E, and the Owner (NCANG), during and at the end of construction prior to building acceptance/occupancy. Note that each facility, the C-17 Hangar, and the Flight Simulator Training Facility requires a ‘separate’ LEED certification. Refer to specification section 01 81 13 –“Sustainable Design Requirements” (LEED) and specification section 01 91 13—“General Commissioning Requirements” for the C-17 Hangar, and the Flight Simulator Facility current specific LEED points and Certification criteria.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work includes, but not limited to, all labor, materials, equipment and incidentals necessary to construct a complete and fully functional new C-17 Corrosion Control / Fuel Cell Hangar and
a Flight Training Simulation Facility that will provide two modern facilities in support of current and future requirements for the 145th Airlift Wing for the North Carolina Air National Guard. The new Hangar facility includes: a fuel cell aviation maintenance hangar with supporting wash gear drying area, tool crib, supervisor office, open offices, and work stand and equipment storage. Additional hangar support functions are: shops for corrosion treatment, corrosion repair, paint stripping and repainting, metal shop, composite shop, supervisor offices, open offices, paint storage, paint mixing, paint booth, dirty restrooms, sanding booth, and booth dust collection areas. The new Flight Simulator Training Facility (SIM Bldg.) includes: full motion simulator bay with supporting weapon system trainer areas and bays, weapon systems computer room, loadmaster station, briefing rooms, communications equipment room, maintenance workroom, maintenance dirty workroom, Storage, learning center, private offices, and an open office area. Additional areas for both facilities (Hangar and SIM) include toilet and break areas, storage, mechanical mezzanines, building circulation, and all other associated supporting facility spaces. New building mechanical, electrical, plumbing, telecommunications, architectural, fire protection systems and equipment (including a HEF aircraft suppression system at the Hangar), site/civil – storm water management features, and structural systems shall also be provided as part of each facility. Site work will consist of grading, aircraft rigid concrete pavement, flexible pavement, sidewalks, curbing, landscaping, exterior lighting, utilities, selective existing utility re-routings, and antiterrorism / force protection (AT/FP) measures.

B. Commissioning: The Commissioning Authority (CxA) is responsible for developing a commissioning schedule and executing a commissioning plan. The CxA is under a separate contract with the Government. Contractor shall coordinate with the CxA.

C. Type of Contract:

1. Project shall be a Firm Fixed price (FFP) contract.

D. Work Sequence:

1. Work will be conducted in a single phase. Additionally, there are Bid Items in the design package (called Optional Line Items – referred to as OLI’s). Refer to Contract Specification Section 01 23 00, “Optional Line Items.”

2. Temporary Government Office (Swing Space) Space: Not required.

1.4 WORK BY GOVERNMENT

A. General: The contractor shall coordinate all required work under the terms and conditions of this contract with the Government to facilitate any other site or project requirements.

1.5 GOVERNMENT-FURNISHED PRODUCTS

A. Government may furnish products to be incorporated into Work by Contractor. Refer to the contract drawings for locations of Installed Building Equipment (IBE) vs. Personal Property (PP). All items indicated in the Contract Documents are considered IBE and a part of this
Contract, except for certain Personal Property (PP), as identified in the Contract Documents that shall be provided and installed by the Contractor.

1.6 ACCESS TO SITE

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

   1. Limits: Limit of Site disturbance shall be as indicated by the Limits of Disturbance in the Contract Documents.
   2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Government, Government'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.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with Government restrictions on construction operations.

B. On-Site Work Hours: Limit work on the Air National Guard Base, Hangar and Flight Simulation site area to normal business working hours of 7:00 a.m. to 3:30 p.m., Monday through Friday, except Federal and State Government observed holidays as follows:

   1. New Years Day
   2. Martin Luther King’s Birthday
   3. Presidents Day
   4. Good Friday
   5. Memorial Day
   6. Independence Day
   7. Labor Day
   8. Columbus Day
   9. Election Day
   10. Veterans Day
   11. Thanksgiving Day
   12. Christmas Day

C. Existing Utility Interruptions: Do not interrupt utilities serving adjacent facilities occupied by Government or others unless permitted under the following conditions and then only after providing temporary utility services maintaining continuity of service according to requirements indicated:

   1. Notify Government not less than five days in advance of proposed utility interruptions.
   2. Obtain Contracting Officer’s written permission before proceeding with utility interruptions.
3. This project requires the refurbishment of an existing active Fire Water Storage Tank (Tank #137) as part of this project. The tank is located on the west side of the Hangar Project Site area. The outage limitations for shutting down the existing Tank shall not exceed thirty (30) days in order to perform the necessary repairs and connections as defined within these Contract Documents. This maximum duration is inclusive of all efforts to include but not limited to: drainage, inspections, repairs and connections, refill, etc. In addition, the Government shall be notified not less than fourteen (14) days in advance of proposed outage date. The Contactor shall include this activity within the CPM Schedule for Government review and approval.

D. Excavation: Notify Government/COR no less than thirty days in advance of proposed excavation activities, and coordinate proposed excavation activities with all required permit review/issuance periods.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

F. Employee Identification: Contractor shall comply with all Charlotte-Douglas Air National Guard Base (ANGB) employee identification requirements.

G. Employee Screening: Contractor shall comply with all Charlotte-Douglas Air National Guard Base (ANGB) requirements for employee screening requirements.

H. Employee Access: Contractor shall comply with all Charlotte-Douglas Air National Guard Base (ANGB) installation entry control procedures for all contractors, subcontractors, and suppliers. The contractor shall obtain the necessary passes and/or identification for entry into the work site for the contractor, subcontractor, and suppliers prior to the commencement of work. The Contractor shall maintain and provide the Government a current roster of all subcontractors and provide any changes immediately to the Government. Procedures and limitations for installation entry control procedures will be supplied to the contractor at the pre-construction meeting.

I. Federal Aviation Administration (FAA) Identification: Contractor shall be responsible for obtaining FAA identification badges required while working in FAA jurisdictional areas (such as the flight line).

1.8 MISCELLANEOUS REQUIREMENTS

A. The General Contractor shall be thoroughly familiar with the Drawings and Specifications to ensure against misunderstanding between trades during entire construction of project. If there is a conflict between different contract documents, the contractor shall submit a Request for Information to clarify the discrepancy prior to proceeding and/or installing the item/work.

B. Rough-In: All rough-in for all items of work and materials indicated on the Drawings or in the Specifications, except as may be specifically excluded, shall be furnished and installed, complete, by the Contractor.
C. Site Preparation: All site preparation work shall proceed with due care and safety for personnel and pedestrians. All operations shall be planned to cause the minimum amount of interference with normal routine and functioning of existing facilities on the Charlotte-Douglas ANGB.

D. Preservation and Restoration of Property: Contractor shall be responsible for the preservation of all public and private property on the surface or underground, along and adjacent to the work, and shall conduct their operations in a manner that will ensure against injury or damage thereto. Work shall be accomplished within the Limits of disturbance indicated on the Contract documents.

E. Where any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work, or because of non-execution thereof, on the part of the Contractor, such property shall be restored by the Contact, at no cost to the Government, to a condition equal to that existing before such damage was done, by repairing, rebuilding or otherwise restoring same in a manner acceptable to the Government.

F. All work performed under this Contract shall proceed with due care and safety for all personnel, pedestrians, and vehicular traffic. All work shall be planned so that the Project can be secured against unauthorized entry at the end of each working day.

G. Although every endeavor has been made, on the Drawings and in Specifications to show all new and existing conditions, it will be the Contractor’s responsibility to fully and carefully evaluate drawings and jobsite conditions prior to submitting the bid proposal. It is not the intent of the Contract to pay the Contractor for work due to deviations from Drawings and Specifications.

H. The Contractor is responsible for the identification, obtaining, and payment of all Construction Permit and tapping fees (both temporary and final hook-up) that may be required for the construction of the project. This shall include general/utility/excavation permits, tapping permits or fees, etc., as may also be required by the Government and/or local utility authorities.

I. The Geotechnical Investigation Report that was completed in December-2016 (for Hangar), and March-2017 (for SIM Bldg.) for the NCANG C-17 Corrosion Control / Fuel Cell Hangar Project is available under separate cover and shall be considered Supplemental information only (e.g. non-binding) for the Contractor's use. The Contract Plans and Specifications have taken into consideration the discussions and recommendations in the report and govern as construction requirements. The Contractor is required to verify all existing conditions necessary for proper installation, construction, and operation of all elements indicted in, and in accordance with the Contract documents.

J. This project site area(s) within the overall Charlotte-Douglas Air National Guard Base (ANGB) may be located within an ‘active construction site’ under a separate project(s) (and GC’s). The Contractor shall be responsible (material, labor, and all applicable fees), and/or coordinate with all other GC’s, to maintain and/or provide all provisions that exist on-site or that are required per the Contract Documents to include but not limited to Erosion & Sediment Control Plan, Temporary Utility Connections, etc. Contractor shall coordinate with other GC’s working within the Charlotte-Douglas ANGB installation to ensure all separate construction activities, to include but not limited to: site access, staging area(s), etc. (of all separate projects) shall not be interrupted.
K. This project may utilize stockpiled spoil material that is located within the Charlotte-Douglas Air National Guard Base (ANGB), and is anticipated to be used as a borrow source to establish finish grades. The Contractor shall be responsible for ensuring borrow materials adhere to the material requirements provided in Specification 31 20 00 EARTH MOVING and final cubic yardage available for use. Coordinate with and obtain approval from Base Civil Engineer POC prior to accessing the borrow site.

1.9 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. 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.

1.10 SAFETY REQUIREMENTS

A. The Contractor shall provide and maintain all necessary fences, barricades and other reasonable safeguards required to ensure the safety of all personnel.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00
SECTION 01 14 16 – COORDINATION WITH NORTH CAROLINA AIR NATIONAL GUARD (NCANG) & CHARLOTTE-DOUGLAS AIR NATIONAL GUARD BASE (ANGB)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

2. Safety and Protection of Work and Existing Property.
3. Use of Premises.

1.2 SECURITY/TRAFFIC CONTROL

A. Site access and excavation permits obtained through Charlotte-Douglas Air National Guard Base (ANGB), by going through the North Carolina Air National Guard (NCANG), will be required in advance of any access to Charlotte-Douglas ANGB by the Contractor to commence work. This shall include permits, tapping permits or fees, etc., as may also be required by Charlotte-Douglas ANGB, and/or other Government and/or local utility authorities. The Contractor is responsible for obtaining and payment of all Construction Permit and tapping fees that may be required. Additional requirements will be discussed at the Pre-Construction Conference.

1.3 SAFETY AND PROTECTION OF WORK AND EXISTING PROPERTY

A. General.

1. The Contractor shall take all required steps to prevent injury to persons (including employees) and property in performance of this Contract, including all steps and actions required under safety provisions of applicable laws and applicable construction codes.

B. Work Performance

1. Contractor shall provide for the safety and protection of the Work at all times. Contractor shall provide protection at all times against rain, wind, storms, and condensation or heat so as to maintain all work, equipment and materials free from injury or damage. At the end of each day, all new work likely to be damaged shall be protected and covered.
2. Contracting Officer shall be notified immediately at any time operations are stopped due to conditions which make it impracticable to continue operations safely or to obtain proper results.
3. Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations, pits and trenches and ducts free of water. The pumped water shall be pumped into a container and disposed of in appropriate areas.

4. Floors shall be protected from damage by proper covering and care when handling heavy equipment or handling mortar or other such materials, and proper cribbing and shoring shall be used to prevent overloading of floors while moving heavy equipment. Provide metal pans under pipe-threading machines and clean such pans daily, keep oil off floors and restore floors to former condition where damaged or stained.

C. Existing Property

1. Contractor shall provide for the safety and protection of existing property at all times. Any damage to existing facilities resulting from construction operations shall be reported immediately to the Contracting Officer and Charlotte-Douglas ANGB point of contact and be promptly repaired, subject to the approval of the Contracting Officer, by the Contractor at no additional cost to the Government.

2. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

3. The applicable requirements specified for protection of the Work shall also apply to the protection of existing property.

4. Before acceptance of the Work by the Contracting Officer, Contractor shall restore all property affected by its operation to the original or better conditions.

1.4 USE OF PREMISES

A. Coordinate the use of premises under direction of Contracting Officer and his duly authorized representative.

B. The Contractor shall be required to comply with all Federal Aviation Administration (FAA), Transportation Security Administration (TSA), and Charlotte-Douglas International Airport rules, regulations, and requirements affecting the project. This includes, but is not limited to, temporary (cranes, etc.) and permanent obstructions, FAA-approved lighting and marking, approved temporary security fencing and gates, and construction barricades. All airport access point modifications shall be coordinated with and approved by all AHJ’s.

1.5 SECURITY PLAN

A. Contractor shall ensure that all rules and regulations that pertain to safety and security are strictly adhered to at all times that Work is conducted.

B. Identification requirements pertaining to access to Charlotte-Douglas ANGB will be discussed at the Pre-Construction Conference. Construction workers will be subject to lunchbox/tool box inspections. Access gate(s) will the only authorized entry and exit points to the work area for the construction company personnel, coordinated through the NCANG Contracting Officer and Charlotte-Douglas ANGB representative(s).
C. Vehicle passes, if required, will be issued by the Government on an as-needed basis only, coordinated through the NCANG Contracting Officer. Vehicles found to be violating safety procedures (speed limits, etc.) may not be allowed re-entry from date of violation.

D. Contractor shall provide Contracting Officer 24 hour notice for overtime work during regular workdays (See Section 01 10 00, "Summary"). Contractor shall provide the Contracting Officer 72 hour notice for requested work on Saturdays, Sundays or holidays observed by the North Carolina Air National Guard.

E. The Contractor shall maintain and provide the Government a current roster of all subcontractors and provide any changes immediately to the Government.

1.6 FOREIGN OBJECT DEBRIS (FOD) REQUIREMENTS

A. FOD Hazards: FOD can severely injure personnel or damage equipment. Types of potential damage include: cutting aircraft tires; being ingested into engines; or becoming lodged in mechanisms affecting flight operations. Personnel injuries can occur when jet blast propels FOD through the site at high velocities.

B. Sources of FOD: FOD comes from many sources, which complicates efforts to maintain safe aircraft movement areas. FOD can be generated from construction activities, personnel, facility infrastructure (pavements, lights, and signs), the environment (wildlife, snow, ice) and the equipment operating on the airfield (aircraft, airport operations vehicles, maintenance equipment, fueling trucks, other aircraft servicing equipment, and construction equipment).

C. Types of FOD. The exact nature of FOD is also varied. FOD can be composed of any material and can be of any color and size. Typical FOD includes the following:

1. Aircraft and engine fasteners (nuts, bolts, washers, safety wire, etc.);
2. Aircraft parts (fuel caps, landing gear fragments, oil sticks, metal sheets, trapdoors, and tire fragments);
3. Mechanics' tools;
4. Catering supplies;
5. Flight line items (nails, personnel badges, pens, pencils, luggage tags, soda cans, etc.);
6. Apron items (paper and plastic debris from catering and freight pallets, luggage parts, and debris from ramp equipment);
7. Runway and taxiway materials (concrete and asphalt chunks, rubber joint materials, and paint chips);
8. Construction debris (pieces of wood, stones, fasteners and miscellaneous metal objects);
9. Plastic and/or polyethylene materials;
10. Natural materials (plant fragments and wildlife); and
11. Contaminants from winter conditions (snow, ice).

D. The Contractor shall provide appropriate manpower and FOD detection equipment to prevent foreign object debris from construction activities to impair and harm the operations of aircraft and personnel.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 01 14 16
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Optional Line Items (OLI’s).

1.2 DEFINITIONS

A. Optional Line Item: 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 Government decides to accept a corresponding change, at any time within during the construction duration, 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. Optional Line Items described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each Optional Line Item is the net addition to or deduction from the Contract Sum to incorporate Optional Line Item into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the Optional Line Item into Project.

1. Include as part of each Optional Line Item, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of Optional Line Item.

B. Execute accepted Optional Line Items under the same conditions as other work of the Contract.

C. Schedule: A schedule of Optional Line Items 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 Optional Line Item.
PART 3 - EXECUTION

3.1 SCHEDULE OF OPTIONAL LINE ITEMS

A. **Optional Line Item No. 001 (OCLIN 002) – OPERABLE PARTITION.** ‘Add’ cost for all materials, equipment, labor, and incidentals to install a manual operable, acoustic paired-panel partition (to include pocket enclosure door panels) at Classrooms H108 and H109. Note that the operation shall replace the gypsum wall board partition as indicated on the Floor Plan. Note also that all infrastructure structural steel supports and bracing required for operable partition installation shall be provided as part of the Base Bid.

B. **Optional Line Item No. 002 (OCLIN 003) – GENERAL HANGAR ITEMS:**
   1. **FUEL RESISTANT RESINOUS FLOORING.** ‘Add’ cost for all materials, equipment, labor, and incidentals to install the Fuel Resistant Resinous Floor at the aircraft Hangar Bay. Refer to Finish Floor plan for extent. Note that the diamond honed sealed concrete floor finish at the aircraft Hangar Bay shall be provided as part of the Base Bid.
   2. **HANGAR FLOOD (TASK) LIGHTING.** ‘Add’ cost for all materials, equipment, labor, and incidentals to install the interior wall mounted maintenance flood task lighting (Fixture Type ‘FL’) to also include: mounting brackets, individual timers & switching, and electrical branch circuit conductors. Note that the Electrical infrastructure to include conduit & junction boxes to fixtures, breaker capacities for entire fixture type, etc. shall be part of the Base Bid.
   3. **ACE HVAC DUCTWORK.** ‘Add’ cost for all materials, equipment, labor, and incidentals to install the complete interior ductwork (from the through-wall connection along column line ‘HA.1’ to ceiling hung hose reel location) to also include the associated hose reel, controller, and electrical branch circuit conductor. Note that the Electrical infrastructure to include conduit, junction boxes, breaker capacity, etc. shall be part of the Base Bid.

C. **Optional Line Item No. 003 (OCLIN 004) – GENERAL EXTERIOR ITEMS:**
   1. **LANDSCAPING & PAVER HARDSCAPE.** ‘Add’ cost for all materials, equipment, labor, and incidentals to install Landscaping (Trees, Shrubs, and Grasses) as shown on Landscape Plans for both the Hangar and Simulation Bldgs. Note that scored concrete entrance sidewalk with joints from both facility entrances (Hangar and Simulation Bldgs.) to perimeter sidewalks, mow strips indicated, and lawn to be provided as part of the Base Bid.
   2. **ORNAMENTAL FENCE & KNEE WALL.** ‘Add’ cost for all materials, equipment, labor, and incidentals to install 7’-0” high fence consisting of a 3’-0” high cast in place concrete knee wall with a 4’-0” high AT/FP compliant ornamental fence above. Note that the 7’-0” high chain link fence shall be provided as part of the Base Bid.
D. Optional Line Item No. 004 (OCLIN 005) – FLIGHT SIMULATOR BLDG Crane.
‘Add’ cost for all materials, equipment, labor, and incidentals to provide the 3 ton under running crane located in Room S127 – Weapon Systems Trainer Bay within the Flight Simulator Building. This OLI shall also include the: structural runway beams, structural support bracing, and electrical branch circuit conductor(s). Note that the Electrical infrastructure to include conduit & junction boxes to final crane location, breaker capacity etc. shall be part of the Base Bid.

E. Optional Line Item No. 005 (OCLIN 006) – MISC. HANGAR ITEMS:
1. DEMOUNTABLE PARTITIONS. ‘Add’ cost for all materials, equipment, labor, and incidentals to install all demountable partitions as indicated on the floor plans (for both the Hangar and Simulation Bldgs.). This OLI shall include all delegated design layout modification/adjustments efforts for all affected components and systems, to include but not limited to: acoustical ceilings, mechanical ductwork and diffusers, lighting, fire suppression locations, etc. required to provide a complete and fully operational Hangar and Simulation facility consistent with all components and systems in lieu of gypsum board partitions as shown in the Base Bid documents.

2. EXTERIOR FLIGHTLINE SIGNAGE. ‘Add’ cost for all materials, equipment, labor, and incidentals to install the internally illuminated, exterior wall mounted 8’-0” high monument lettering as shown on Architectural Exterior Elevation, Sheet A1/A-202. This OLI shall also include all electrical branch circuit conductor(s). Note that the Electrical infrastructure to include conduit & junction boxes to final location of each letter, breaker capacity, etc. shall be part of the Base Bid.

END OF SECTION 01 23 00
SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Coordination with Contracting Officer for special requirements.
3. Administrative and supervisory personnel.
4. Project meetings.
5. Requests for Information (RFIs).

1.2 DEFINITIONS

A. RFI (Request for Information): Request from Contractor, on a specific form provided by the Contracting Officer, seeking Interpretation or clarification of the Contract Documents.

1.3 COORDINATION

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. If there appears to be a conflict on any of the Contract Documents between trades or components/elements of the work done by different trades, or between drawings and specifications, notify the Contracting Officer prior to procuring or installing the component/element by submitting an RFI to the Contracting Officer. The entire set of Contract Documents together represents the entire Contract. If there is any component/element that may be indicated on one part of the Contract Documents and not on another part of the Contract Documents, the General Contractor is still fully responsible for procurement, installation, and testing of that component/element as part of his/her Contract with the Government at no additional cost to the Government. If it requires clarification, an RFI shall be submitted in advance of procurement and installation of such component/element.

2. Coordinate installation of different components with other installers to ensure maximum accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. 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 Government if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other installers 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. The Schedule of Values shall be based on the breakdown format of the DD Form 1354.
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.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Government's property.

E. Coordination with Contracting Officer: Coordination of Work with Contracting Officer includes, but is not limited to, the following:

1. Deliveries of government furnished equipment.
2. Archaeological material, bones, or funerary objects found during construction or excavation.
3. Review of schedules, samples, plans and specifications that indicate information and recommend approval by Contracting Officer.
4. Key schedule and key cylinders: See door schedule on Drawings.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   a. Lighting fixtures.
   b. Suspended ceiling components.
   c. Structural members to which suspension systems for lighting fixtures will be attached.
   d. Other items in finished ceiling including the following:
      1) Air outlets and inlets;
      2) Mechanical ducts;
      3) Piping;
      4) Cable tray;
      5) Speakers;
      6) Sprinklers;
      7) Smoke and fire detectors;
      8) Occupancy sensors;
      9) Access panels;
      10) Projector mounts.

2. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
   a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, plumbing, fire protection, telecommunications, and electrical systems.
   b. Indicate required installation sequences.
   c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Contracting Officer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

3. Sheet Size: At least 11 by 17 inches but no larger than 30 by 42 inches.

4. Number of Copies: Will be established at the Pre-Construction Conference.

5. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections and not specified in this section.

B. Key Personnel Names: Within 15 days of contract award, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities and authorities; list job site telephone numbers (cell phone acceptable), including home office telephone numbers. Provide names, addresses, and cell telephone numbers of individuals assigned as standbys 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 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations.

1.6 PROJECT MEETINGS

A. General: Contractor shall schedule, attend, and conduct meetings and conferences at Project site, unless otherwise directed by the Contracting Officer.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Contracting Officer (CO) of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees. Coordinate with Contracting Officer the meeting agenda for the progress meetings in advance.

3. Minutes: Record significant discussions and agreements achieved for progress meetings. Distribute the meeting minutes for all meetings to everyone concerned, including Contracting Officer within three days of the meeting.

B. Preconstruction Conference: Will be scheduled by the Contracting Officer (CO). Time and location of meeting will be provided by Contracting Officer to the Contractor. All contractor personnel, to include critical/major subcontractor personnel must attend this conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

1. Agenda: Items of significance that will be discussed, include the following, at a minimum:

   a. Protection of construction and personnel.
   b. Tentative construction schedule.
   c. Designation of key personnel and their duties.
   d. Procedures for processing field decisions and Change Orders.
   e. Procedures for RFLs.
   f. Procedures for testing and inspecting.
   g. Procedures for processing Applications for Payment.
   h. Distribution of Documents.
   i. Submittal procedures.
   j. LEED requirements.
   k. Preparation of Record Documents.
   l. Use of the premises.
   m. Work restrictions.
   n. Government's occupancy requirements.
   o. Responsibility for temporary facilities and controls.
q. Parking availability.

r. Office, work, and storage areas.

s. Equipment deliveries and priorities.

t. First aid.

u. Security.

v. Progress cleaning.

w. Working hours.

2. Minutes: Contractor shall record and distribute all meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation 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 Contracting Officer (CO) 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. Protection of construction and personnel.
      c. Options.
      d. Related RFIs.
      e. Related Change Orders.
      f. Purchases.
      g. Deliveries.
      h. Submittals.
      i. Review of Mockups
      j. Possible conflicts.
      k. Compatibility problems.
      l. Time schedules.
      m. Weather limitations.
      n. Manufacturer's written recommendations.
      o. Warranty requirements.
      q. Acceptability of substrates.
      r. Temporary facilities and controls.
      s. Space and access limitations.
      t. Regulations applicable to the issue at hand.
      u. Testing and inspecting requirements.
      v. Installation procedures.
      w. Coordination with other work.
      x. Required performance results.
      y. Protection of adjacent work.

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

D. Progress Meetings: Conduct progress meetings at bi-weekly intervals. Intervals may change with the approval of the Contracting Officer. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of the Government, subcontractors, suppliers, and other entities concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Contracting Officer or his representative will review and comment on minutes of previous progress meeting. Review with Contracting Officer (CO) other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Provide a written report reviewing progress in the past two weeks, and the next two weeks. 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 Performance Period.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) RFIs.
16) Status of proposal requests.
E. Coordination Meetings: 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 pre-installation conferences.

1. Attendees: In addition to representatives of Government, Contracting Officer (CO), and Architect (as necessary), 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 conference 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 subcontract 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 Performance Period.

b. Schedule Updating: There will be NO revision to the schedule unless it is due to an approved change order. If the change order required to revise the schedule is approved, revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each subcontractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.
14) Request for Interpretation.

3. Reporting: Contractor shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
1.7 REQUESTS FOR INFORMATION (RFIs)

A. Procedure: Immediately on discovery of the need for information regarding the Contract Documents, and if not possible to request Information at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs electronically using Contractor-provided Website in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Software-Generated RFIs: Use Electronic Form provided by Contracting Officer for RFI's. Contractor shall provide and use Prolog (or approved equal) website software to upload and track RFI's.

C. Content of the RFI shall include a detailed description of the request and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect and Contracting Officer (CO).
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing Information.

   a. Identify each page of attachments with the RFI number and sequential page number.
   b. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
   c. Attachments shall be electronic files in Adobe Acrobat PDF format uploaded to the Contractor's website along with the RFI form.

D. Contracting Officer's Action: Contracting Officer (CO), or his representative (COR) will review each RFI, determine action required, and return it. Allow fifteen (15) working days for CO’s or COR’s response for each RFI. If the Contracting Officer or COR requires the Design Architect/Engineer-of-Record’s input on an RFI, the Architect/Engineer (A/E) shall have eleven (11) working days to return the RFI with response back to the CO from the date of A/E receipt of the RFI from the CO or COR, or through the Prolog (or approved equal) Website. The Contracting Officer will return the response to the RFI back to the Contractor (through the website). RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for Information of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.

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.
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Contracting Officer in writing within 10 days of receipt of the RFI response.

E. On receipt of Contracting Officer's action, update the RFI log (NOTE: VERIFY RFI LOG AND OTHER LOGS ARE PART OF PRECONSTRUCTION CONFERENCE) and immediately distribute the RFI response to affected parties through website. Review response and notify Contracting Officer within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly (upload weekly on the website). Submit on Prolog (or approved equal) website using MicroSoft Excel with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Contracting Officer (CO).
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's and Contracting Officer (CO)’s response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Change, Change Order, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00
SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor’s Construction Schedule.
5. Daily construction reports.
6. Material location reports.
7. Field condition reports.
8. Special reports.
9. AF Form 3064 Construction Progress Schedule

1.2 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 activities are activities on the critical path. They 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 Contracting Officer (CO.)

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 the government or Contractor, but is a jointly owned, expiring project resource available to both parties as needed to meet schedule milestones and the specified 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. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.3 SUBMITTALS

A. Quantities of copies to be submitted are for bidding purposes only. Number of copies will be discussed at Pre-Scheduling Conference.

B. Submittals Schedule: Submit three hard copies of ‘Submittals Schedule’ within 30-days after Notice-To-Proceed, and, upload on Prolog website or equal software website approved by COR. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for CO's final release or approval.
7. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.

C. Preliminary Network Diagram: Submit three hard copies, large enough to show entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Submit three hard copies of initial schedule, large enough to show entire schedule for entire construction period.

1. Submit an electronic copy of schedule, using software indicated, on CD-ROM, and upload on Prolog website. The schedule shall be 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 three hard copies of each of the following computer-generated reports, and, upload reports on the prolog website. 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 the Notice to Proceed until most recent Application for Payment.

F. Daily Construction Reports: Submit (upload on Prolog website, or other software approved by COR) three copies at bi-weekly intervals.

G. Construction Progress Reports: Submit (upload on Prolog website or other software approved by COR) three copies at bi-weekly intervals.

H. Material Location Reports: Submit (upload using Prolog website, or other software approved by the COR) three copies at monthly intervals.

I. Field Condition Reports: Submit (upload on Prolog website or other software approved by COR) three copies at time of discovery of differing conditions.

J. Special Reports: Submit (upload on Prolog website or other software approved by COR) three copies at time of unusual event.

1.4 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling (using Primavera P3 or P6 software, or other equal software approved by the CO) and reporting, with capability of producing CPM reports and diagrams within 24 hours of Contracting Officer's request. Scheduling Consultant may be either Contractor employee or subconsultant and shall be approved by Contracting Officer.

1. Contractor is also required to provide an AF Form 3064 Progress Schedule by CLIN to be used for payment purposes. Progress shall be reported on an NGB Joint Progress Report and coordinated with the COR prior to submission with application for payment.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, "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 work stages, area separations, interim milestones, and partial Government occupancy.
5. Review schedule for work of Government's separate contracts.
6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. Review submittal requirements and procedures.
11. Review procedures for updating schedule.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary network diagram. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.
2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in Association of General Contractors (AGC's) "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by approved Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by CO.
2. Procurement Activities: Include procurement process activities for the long lead items and major items (a complete list of the long lead items and major items will be identified during pre-construction meeting), 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.
4. Startup and Testing Time: Include not less than 15 days for startup and testing.
5. Final Completion: Indicate completion in advance of date established for Final Completion, and allow time for CO's administrative procedures necessary for certification of Final Completion.

D. 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 Government: Include a separate activity for each portion of the Work performed by Government.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date. Delivery dates indicated stipulate the earliest possible delivery date.
5. Government-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Special Requirements. 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. Use and Possession Prior to Completion.
   e. Use of premises restrictions.
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. Startup and placement into final use and operation.

8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Permanent space enclosure.
c. Completion of mechanical installation.
d. Completion of electrical installation.
e. Final Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Work accepted by the Contracting Officer prior to Final Completion, and Final Completion and the interim milestones as discussed in the pre-construction meeting.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Conditions of the Contract for cost reporting and payment procedures.
2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with CO's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
3. Each activity cost shall reflect an accurate value subject to approval by CO.
4. Total cost assigned to activities shall equal the total Contract Sum.
G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

H. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules:

1. Provide Primavera P3 software, or equal software approved by COR for use on this Project.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed, and, upload on Prolog website. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.


1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date of contract award.
   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 CO'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. Include list of nonworking days and holidays incorporated into the schedule.

D. The Commissioning Authority will provide to the Contractor a Schedule in CPM format identifying the Cx activities for the project. The Contractor shall incorporate these Cx activities into the Master Project Schedule. The Cx Authority will review and update Cx Activities along with the Contractor's Master Schedule Update.

E. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary 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 Government that may affect or be affected by Contractor's activities.
i. Testing and commissioning.

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 Performance Period.

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.

F. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal 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.
10. Dollar value of activity (coordinated with the Schedule of Values).

G. Schedule Updating: There should be NO revision to the original schedule unless it is due to an approved change order. Concurrent with making revisions to schedule, if the revision is approved, 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.
5. Changes in the critical path.
6. Changes in total float or slack 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.

2.4 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.
   8. Meetings and significant decisions.
   9. Unusual events (refer to special reports).
   10. Stoppages, delays, shortages, and losses.
   11. Meter readings and similar recordings.
   13. Orders and requests from anyone other than the Contractor or Government.
   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. Work accepted by the Contracting Officer prior to Final Completion.

B. Material Location Reports: At monthly 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.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Include a detailed
description of the differing conditions, together with recommendations for changing the Contract Documents. Provide information on form acceptable to the Contracting Officer.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Government within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Government 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: Government 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 monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week 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 Actual Completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to CO, COR, testing and inspecting agencies, and other parties identified by Contractor or CO 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 01 32 00
SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Critical Submittals: The Government has identified critical submittals for this project. These submittals shall be provided to the CO for approval within 45 days of the award of the Contract. Critical submittals have been identified in the attached ANG submittal register.

C. Provide, use, and manage Prolog Website software, or approved equal, to upload and track submittals (and RFI's).

    1. Contractor shall provide training to Government personnel for use and administration of website software system. Training shall include an on-site, training work session for government & A/E personnel to adequately familiarize all participants of the system. Contractor shall provide copies of software and/or licenses to all participants if required for use of website based software system.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires responsive action.

B. Informational Submittals: Written information that does not require responsive action. Submittals may be rejected for not complying with requirements.

C. Critical Submittals: The Government has identified critical submittals for this project. These submittals shall be provided to the CO for approval within 45 days of the award of the Contract. Critical submittals have been identified in the attached submittal register.

D. Contracting Officer (CO): Contracting Officer or Contracting Officer's Representative (COR) acting on behalf of the Contracting Officer pursuant to the COR written Appointment Letter.

1.3 SUBMITTAL PROCEDURES

A. Number of Copies per Submittal: A set number of copies per submittal will be established per Section 01 32 00, "Construction Progress Documentation" during the Pre-Construction meeting. Quantities stated in this section are to be used for bidding purposes only.

B. General: CAD Drawings will be available to the Contractor for non-binding informational purposes only, and will be available at approximate commencement of construction / kick-off
meeting timeline. Correctness and accuracy in the preparation of all submittals in which the CAD files are used for reference purposes shall be the responsibility of the Contractor.

C. 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. 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. CO reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Submittals Schedule: Comply with requirements in Section 01 32 00, "Construction Progress Documentation" for list of submittals, time requirements for scheduled performance of related construction activities and anticipated dates for forwarding submittals to Contracting Officer.

E. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Contracting Officer'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 working-days for initial review of each submittal (this includes transmission of the submittal from the CO or COR to the A/E, and return of the reviewed submittal by the A/E back to the CO or COR). Allow additional time if coordination with subsequent submittals is required. CO will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 10 working-days for review of each resubmittal.
3. Sequential Review: Where sequential review of submittals by multiple Disciplines within the Architect’s (A/E’s) firm are required, or reviews are required by the Architect’s consultants, Government, or other parties, allow 18-working days for initial review of each submittal. The requirement of sequential review will be determined by the Contracting Officer and allow 10 working-days for review of each resubmittal.
   a. A list of Specification Sections requiring sequential review will be discussed during pre-construction conference.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 18 calendar days for review of each initial submittal. Submittal will be returned to CO, through Architect, before being returned to Contractor.
   a. A list of Specification Sections allowing concurrent review will be discussed during pre-construction conference.

F. Identification: Place a permanent label or title block on each submittal 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 on label or beside title block to record Contractor's review and approval markings and action taken by CO.

3. Include the following information on label for processing and recording action taken:
   
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name and address of Contractor.
   e. Name and address of subcontractor.
   f. Name and address of supplier.
   g. Name of manufacturer.
   h. Submittal number or other unique identifier, including revision identifier.

   1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

   i. Number and title of appropriate Specification Section.
   j. Drawing number and detail references, as appropriate.
   k. Location(s) where product is to be installed, as appropriate.
   l. Other necessary identification.

G. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

H. Additional Copies: Unless additional copies are required for final submittal, and unless CO observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to CO.
2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. CO will return submittals, without review, received from sources other than Contractor. Submittals will be transmitted electronically on the Prolog (or approved equal) Website. All electronic submittals shall have a cover transmittal sheet; transmittal shall be the form approved by the Contracting Officer.

1. Transmittal Form: Use transmittal form approved by the Contracting Officer.

   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
g. Submittal purpose and description.

h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Transmittal number, numbered consecutively.
k. Submittal and transmittal distribution record.
l. Remarks.
m. Signature of transmitter.

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

J. The Commissioning Authority will review product submittals and shop drawings within the same review period as the Government. The Cx Authority will review the submittals and shop drawings for Cx process related information and issue review comments directly to the Contracting Officer.

K. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "APPROVED" or "APPROVED AS NOTED."

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

M. Use for Construction: Use only final submittals with mark indicating "APPROVED" or "APPROVED AS NOTED." Submittals stamped by Contracting Officer or duly appointed representative, as "Approved" or "Approved as Noted," are informational only. The stamp does not mean that the submittal was checked for accuracy, completeness, or appropriateness and Contractor is not relieved of responsibilities under this Contract.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections. List only one (1) item per submittal.

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 printed 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 written recommendations.
   b. Manufacturer's product specifications.
   c. Manufacturer's installation instructions.
   d. Standard color charts.
   e. Manufacturer's catalog cuts.
   f. Wiring diagrams showing factory-installed wiring.
   g. Printed performance curves.
   h. Operational range diagrams.
   i. Mill reports.
   j. Standard product operation and maintenance manuals.
   k. Compliance with specified referenced standards.
   l. Testing by recognized testing agency.
   m. Application of testing agency labels and seals.
   n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.

5. Number of Copies: Submit four copies of Product Data, unless otherwise indicated. CO will return two 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. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   f. Shopwork manufacturing instructions.
   g. Templates and patterns.
   h. Schedules.
   i. Design calculations.
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.
   m. Relationship to adjoining construction clearly indicated.
   n. Seal and signature of professional engineer if specified.
   o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Number of Copies: Upload Shop Drawings onto Prolog website, and, Submit five (5) hard copies of each submittal (if required by the Contracting Officer), unless copies are required for operation and maintenance manuals. If hard copies are required by the CO, the CO will retain two copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Government's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit four full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. CO will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit four sets of Samples. CO will retain two Sample sets; remainder will be returned.

   1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: 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.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit four copies of product schedule or list, unless otherwise indicated. CO will return two copies.

F. Testing and Inspection Agent: Submit qualifications of any required Independent Testing and Inspection Agent in advance for Government approval. Government approved Independent Testing and Inspection Agent shall be contracted directly by the Construction Contractor.

G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00, "Construction Progress Documentation" for CO's action.

H. Submittals Schedule: Comply with requirements specified in Section 01 32 00, "Construction Progress Documentation."

I. Application for Payment: Comply with Contracting Officer's instructions for submission and processing.

J. Schedule of Values: Comply with requirements specified by the Contracting Officer. Submit Schedule of Values to include line items for all independent testing agency costs.

K. 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. Use form acceptable to Contracting Officer. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit four copies of subcontractor list, unless otherwise indicated. Contracting Officer, will return two copies.

L. LEED Submittals: Comply with requirements specified in section 01 81 13 “Sustainable Design Requirements”.

1. Number of copies: Submit four copies, (and upload onto Prolog or approved equal website) of LEED submittals, unless otherwise indicated.
2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal (upload on the Prolog website), unless otherwise indicated.
2. Certificates and Certifications: Provide a notarized 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.
3. Test and Inspection Reports: Comply with requirements specified in Section 01 40 00, "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Section 01 31 00, "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00, "Construction Progress Documentation."

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

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

F. Installer Certificates: Prepare 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.

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

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

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

J. Material Test Reports: Prepare 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.

K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to the Contracting Officer, that product complies with building code in effect for Project. Refer to Drawings for applicable Building Codes. 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.

M. Schedule of Tests and Inspections: Comply with requirements specified in Section 01 40 00, "Quality Requirements."

N. Preconstruction Test Reports: Prepare 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.

O. Compatibility Test Reports: Prepare 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.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Section 01 78 23, "Operation and Maintenance Data."

R. Design Data: Prepare 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.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

T. Test Results: All test results shall be a required submittal to the Government.

U. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service 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.

V. Construction Photographs: Comply with requirements specified in Section 01 32 33, "Photographic Documentation."

W. Material Safety Data Sheets (MSDSs): Submit 1 copy to Contracting Officer. Contractor shall retain 1 copy of each MSDS at the Project Site.

2.3 DELEGATED DESIGN

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 an RFI to CO.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit four copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with all Contract requirements. Note corrections and field dimensions. Mark with approval stamp before submitting to CO.

B. 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.

C. The attached Submittal Register is for information only. Contractor shall verify submittal requirements for each specification section which will take precedence over this chart and submit for review as specified in each Section.

3.2 CONTRACTING OFFICER'S ACTION

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

B. Action Submittals: CO will review each submittal, make marks to indicate corrections or modifications required, and return it (through the Prolog website). CO will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. APPROVED
2. APPROVED AS CORRECTED
3. APPROVED AS NOTED
4. REVISE AND RESUBMIT
5. REJECTED
6. REVIEWED – NO COMMENT
7. REVIEWED – WITH COMMENT AS NOTED
8. NO ACTION TAKEN

C. Informational Submittals: CO will review each submittal and may return to Contractor through the Prolog website. CO will forward each submittal to appropriate party, as may be required, through the Prolog website.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents will not be reviewed and will be returned with no action taken.

END OF SECTION 01 33 00
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*Critical Submittal

**SCHEDULE OF MATERIAL SUBMITTALS**

Project Title: North Carolina ANG 145th Wing, C-17 CORROSION CONTROL / FUEL CELL HANGAR PROJECT

**SUBMITTAL REPORT:** FOR INFORMATION ONLY

Contractor shall verify submittal requirements for all Sections.
## SCHEDULE OF MATERIAL SUBMITTALS

**Project Title:** North Carolina ANG 145th Wing, C-17 CORROSION CONTROL / FUEL CELL HANGAR PROJECT

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<thead>
<tr>
<th>Line Number</th>
<th>ITEM OR DESCRIPTION OF ITEM CONTRACT REFERENCE, SECTION NUMBER/TITLE</th>
<th>PRODUCT DATA</th>
<th>SHOP DRAWINGS</th>
<th>SAMPLES</th>
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*Critical Submittal

**SUBMITTAL REPORT:** FOR INFORMATION ONLY

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**SUBMITTAL REPORT: FOR INFORMATION ONLY**
Contractor shall verify submittal requirements for all Sections.
## SCHEDULE OF MATERIAL SUBMITTALS

**Project Number:**

**Project Title:** North Carolina ANG 145th Wing, C-17 CORROSION CONTROL / FUEL CELL HANGAR PROJECT

**Solicitation/Contract Number:**

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### SCHEDULE OF MATERIAL SUBMITTALS

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**Critical Submittal**

Contractor shall verify submittal requirements for all Sections.
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*Critical Submittal

SUBMITTAL REPORT: FOR INFORMATION ONLY
Contractor shall verify submittal requirements for all Sections.
## SCHEDULE OF MATERIAL SUBMITTALS

**Project Title:** North Carolina ANG 145th Wing, C-17 CORROSION CONTROL / FUEL CELL HANGAR PROJECT

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<th>MANUFACTURER'S RECOMMENDATIONS</th>
<th>MATERIAL TEST REPORTS/CERTIFICATES</th>
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## SCHEDULE OF MATERIAL SUBMITTALS

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SECTION 01 35 43 - SAFETY, HAZARDOUS MATERIALS AND HEALTH REQUIREMENTS

PART 1 - GENERAL

1.1 SAFETY REQUIREMENTS

A. Comply with US Army Corps of Engineers EM 385-1-1.

B. Prior to commencing work, contractor shall prepare and submit a site/project Health and Safety Plan in accordance with Item A and also in accordance with Occupational and Health Act (OSHA) 1910 Standards that are applicable to construction. Government review and approval is required prior to commencement of work.

1.2 HAZARDOUS MATERIALS REQUIREMENTS

A. Contractor shall establish a hazardous material (HM) storage and distribution system when HM is to be used. All HM required to support the Contract shall be identified in a HM Log. The Form may be altered to enhance tracking. The Contractor HM Identification Form will be provided to the Contractor at or prior to Pre-Construction Conference. Additional HM needed by the Contractor shall be identified to the Contracting Officer's Representative for approval.

B. The Contractor planning to use HM for the work shall register with the installation HM prior to start of Work in order to support the installation's compliance with Executive Order 12856. Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements.

C. The Contractor shall maintain a Contractor HM Identification Form for all HM on the job site for inspection/verification.

D. The Contracting Officer will verify that the HM identified to the Contracting Officer (CO) is the only HM in use on the job site.

E. The Contractor shall provide the following to the HMP:

1. Provide a list of each material and quantity of material for all proposed HM. Hazardous Material shall be construed to mean any item that is:
   a. A health hazard or physical hazard as defined in 29 CFRR, 1910.1200(c).
   b. Regulated in its disposal by EPA under 40 CFR.
   c. Hazardous as defined by DOT regulations under 49 CFR.
   d. Hazardous as defined by the Dangerous Goods Regulations of the International Air Transport Association.

2. Provide a material safety data sheet (MSDS) for each item on the HM list.

3. Typical examples of hazardous materials that may be used on a job site may include but are not limited to:
SAFETY, HAZARDOUS MATERIALS AND HEALTH REQUIREMENTS

1.3 HEALTH AND SAFETY REQUIREMENTS

A. All products and materials used in connection with this project shall remain asbestos-free, lead-free, and mold-free.

B. If hazardous waste materials are detected or generated at any time, the Contracting Officer shall be immediately notified of each and every occurrence. No work shall be performed in any area with suspected hazardous containing materials without the prior authorization of the Contracting Officer.

C. In accordance with OSHA, the Contractor shall be responsible for compliance with applicable laws, codes, rules, regulation and standards with respect to safety and health. The Contractor shall inspect and report compliance with all safety and health regulations in accordance with the requirements. The Contractor shall monitor and provide the project with adequate safeguards, including but not limited to the proper fencing, barricades, clothing equipment, waste containers, and storage units that are necessary for the protection of its employees.

D. If emergency condition should develop during the entire project, the Contractor shall immediately notify the Contracting Officer of each and every occurrence. The Contractor shall also recommend appropriate courses of action to the Contracting Officer.

E. The Contractor shall provide for the maintenance of traffic and the protection of the public from damage to person or property, within the limits of and for the duration of the Contract, through
completion. This requirement shall include furnishing, installing and maintaining temporary construction signs, sign supports, coned, arrow board trailers or arrow panels, truck mounted and other safety equipment, and maintenance of traffic control devices or methods as directed by the Contracting Officer or his duly authorized representative.

1.4 ACCIDENTS AND PERSONNEL INJURIES

A. The Contractor shall provide such equipment and facilities as necessary or required in case of accident and/or personal injury, for first aid service to anyone who may be injured during the progress of Work within the limits of and for the duration of the Contract. In addition, the Contractor shall have standing arrangements for the removal and hospital treatment of any person who may be injured or who may become ill on the job site.

B. The Contractor shall report immediately to the Contracting Officer any accident and/or personal injury resulting in lost time to employees. Also, notify the Contracting Officer of vehicle accidents or any accident resulting in damage to Government property, or the public, and furnish in writing full information including testimony of witnesses regarding any and all accidents and injuries.

1.5 PERSONAL SAFETY EQUIPMENT

A. For the duration of the Contract and in accordance with OSHA, the Contractor shall take responsibility to ensure that all its employees are provided with the necessary personal protective equipment (PPE) including any required personnel traffic safety equipment. Personal protective equipment as required shall include, but not be limited to, the approved hard hats, safety shoes, gloves, goggles, eye/face shield protections, safety belts, harnesses, respirators, hearing protection, traffic safety vests, etc.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 35 43
SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This 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 requirements.

1. Specific quality-assurance and quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract requirements.

3. Requirements for Contractor to provide quality-assurance and quality-control services required by Government or Contracting Officer (CO) are not limited by provisions of this Section.

4. Contractor is responsible for hiring the qualified testing agency, and paying for the testing and inspecting services. Testing Agency shall be approved by Contracting Officer.

5. Contractor shall provide all test equipment and labor to perform the functional performance testing procedures under the oversight of the Cx Authority.

C. Related Sections include the following:

1. Divisions 2 through 33 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

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

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

C. Mockups: Full-size physical assemblies that are constructed on-site and within laboratories. 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 tolerances. Mockups are not samples. Approved
mockups establish the standard by which all Work will be judged.

D. Preconstruction Testing: Tests and inspections that are performed specifically for the 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 the Contracting Officer, to
establish product performance and compliance with industry standards.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e.,
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 or a Subcontractor at any tier to perform a particular construction operation, including
installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must
be performed by accredited or unionized individuals of a corresponding generic name,
such as "carpenter." It also does not imply that requirements specified apply exclusively
to trades people of the corresponding generic name.

J. Experienced: When used with an entity, "experienced" means having successfully completed a
minimum of five previous projects similar in size and scope to this Project; being familiar with
special requirements indicated; and having complied with all requirements of the Contract,
federal, local and municipal laws and regulations.

1.3 CONFLICTING REQUIREMENTS

A. General: 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 uncertainties and requirements that are different, but
apparently equal, to the Contracting Officer for a decision before proceeding using the specified
RFI format, as approved by the Contracting Officer.

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 Contracting Officer (CO)
for a decision before proceeding using the specified RFI format.
C. Contractor shall hire and pay for all independent Testing and Inspection Agents required during the entire construction, and the Qualifications for all such Independent Testing and Inspection Agents shall be submitted to the Contracting Officer (CO) in advance for government approval prior to the Independent Testing and Inspection Agents commencing with any work. This Section shall prevail when discrepancies between this Section and individual technical sections, Division 2 through Division 33, are found.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" 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.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that 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.
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.

D. Permits, Licenses, and Certificates: For Government'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.
1.5 QUALITY ASSURANCE

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

B. 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.

C. 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.

D. 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.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Maryland 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 products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications 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. Requirement for specialists shall not supersede building codes and regulations governing the Work.

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 548; and with additional qualifications specified in individual Sections; that is acceptable to the Contracting Officer. Submit a list of 3 firms to the Contracting Officer for review and approval.

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. 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.

I. 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 as defined herein.
   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 Work is complete, remove test specimens, assemblies, mockups, and laboratory mockups that are not integral to Project construction.
   g. Notify Contracting Officer (CO) seven days in advance of dates and times when mock-ups will be constructed.
   h. Demonstrate the proposed range of aesthetic effects and workmanship of mock-ups.
   i. Obtain Contracting Officer’s (CO’s) approval of mock-ups before starting the work, fabrication or construction.
   j. Allow seven days for initial review and each re-review of each mockup.
   k. Maintain Exterior and Interior Mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   l. The Cx Authority will prepare and issue to the Contractor a Pre-Functional Verification Checklist form for each system or major piece of equipment scheduled for commissioning.
   m. The Contractor shall complete each Checklist as required in Section 01 91 13 "General Commissioning Requirements."
   n. The Cx Authority will monitor and track the completion of the checklist forms.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Contracting Officer (CO), with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.6 QUALITY CONTROL

A. Government Responsibilities: Government will review qualification of the testing agency to perform these services.

B. Perform quality-control services on all aspects of the Work, whether specified or not.
   1. Engage a qualified testing agency to perform these quality-control services.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract are Contractor's responsibility.

5. Submit additional copies of each written report as directed by the Contracting Officer.

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 01 33 00, "Submittal Procedures."

D. Retesting/Reinspecting: Provide quality-control services, including retesting and reinspecting, at no additional cost to the Government for construction that replaced Work that failed to comply with the Contract.

E. Testing Agency Responsibilities: Cooperate with Contracting Officer (CO) and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

   1. Notify Contracting Officer (CO), 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 directly to the CO and Contractor.
   5. Do not release, revoke, alter, or increase the Contract requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

F. 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.

G. 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.
H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract. Submit schedule within 30 days after contract award.

1. Distribution: Distribute schedule to Contracting Officer (CO), testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.7 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency approved by the Contracting Officer, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Contracting Officer (CO) 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 the Contracting Officer (CO) with copy to Contractor and as directed by the Contracting Officer.
4. Submitting a final report of special tests and inspections at 95% 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.
6. Retesting and reinspecting corrected work at no additional cost to the Government.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. 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 Contracting Officer.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Contracting Officer (CO)'s reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

2. Comply with the Contract requirements for Section 01 73 29, "Cutting and Patching."

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 01 40 00
STATEMENT OF SPECIAL INSPECTIONS

This Statement of Special Inspections is submitted in accordance with the Special Inspection and Testing requirements of the Building Code (Chapter 17 of IBC) and UFC 3-301-01.

It shall be noted that contractual relationships and the composition of the Architect / Engineer/ Construction (AEC) team differ from that contemplated by the language of IBC. IBC/ASCE/SEI terms of Authority Having Jurisdiction and Building Official shall be as defined in UFC 1-200-01. Unless noted otherwise the following substitutions shall apply for implementing the IBC:

2. Owner: Interpreted as Authority Having Jurisdiction.

This Statement of Special Inspections includes the Schedule of Special Inspections, Article 3.1 of Section 01 45 35 SPECIAL INSPECTIONS, applicable to this project. The Contractor shall identify the Special Inspection Coordinator and other Approved Agencies to be retained for conducting these inspections and tests to the Contracting Officer. The Contractor shall retain the services of one or more Approved Agencies to provide Special Inspections and tests during construction on the types of work specified in the Schedule of Special Inspections. These special inspections and tests are in addition to the quality control inspections by the Contractor that are identified elsewhere in the Contract Documents.

This Statement of Special Inspections encompasses the following disciplines:

- [x] Structural
- [x] Mechanical/Electrical/Plumbing
- [x] Architectural
- [x] Other: Geotechnical / Site Preparation

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Contracting Officer and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Contracting Officer and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Contracting Officer.

A Final Report of Special Inspections documenting completion of all required Special Inspections, Testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

The designated materials, systems, and components listed below are required to have special inspections or tests. See the Schedule of Special Inspections and the Contract Documents for specific Special Inspection and Test requirements regarding the type and extent of each special inspection or test.

1. Structural components, including beams, columns, slabs, walls, foundations, stairs, roofs, anchors and connecting elements. Refer to requirements for Foundations, Masonry, Structural Steel, Cold-Formed Steel Decks, Open-Web Steel Joists and Joists Girders, Reinforcing Steel, Fabrication, Cold-Formed Metal Framing, and Concrete Construction.
2. For additional Special Inspections and Tests for Wind and Seismic Resistance refer to requirements in the Schedule of Special Inspections.
3. Site elements, including preparation of subgrades. Refer to requirements for Soils.
5. Plumbing, Mechanical, and Electrical components, including suspended elements that are part of Fire protection and Fire Alarm Systems. Refer to requirements for Plumbing/Mechanical/Electrical Designated Seismic Systems.
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for special inspections for this Project in accordance with IBC 2015 and UFC 3-301-01.

1.2 DEFINITIONS

A. Continuous special inspection: continuous special inspection is the full time observation of the work by the special inspector present in the work area whenever work is being performed. Perform continuous special inspection where specified for items as indicated per this section and chapter 17 of IBC.

B. Periodic special inspection: periodic special inspection is the intermittent observation of the work by a special inspector present in the work area while work is being performed. The intermittent observation periods shall be: at times of significant work; recurrent over the complete work period; and total at least 25 percent of the total work time. Perform periodic special inspection where specified for items as indicated per this section and chapter 17 of IBC.

C. Authority Having Jurisdiction, Building Official: U.S. Air Force AFCEC. The enforcement of the codes and standards as they pertain to facility projects can be delegated to the local components office’s chief engineer’s technical representative at the discretion of the components aforementioned office.

D. Special Inspector of Record (SIOR): A licensed professional engineer, acceptable to the authority having jurisdiction, retained by the Contractor as a third party quality assurance agent in accordance with UFC 1-200-01. The SIOR shall submit qualifications acceptable to the authority having jurisdiction.

E. Duties of the special inspector of record (SIOR): duties of the SIOR shall include the following:

1. Supervise all special inspectors required by the contract documents, UFC3-301-01, and the IBC 2015.
2. Submit a letter to the authority having jurisdiction attesting to acceptance of the duties of SIOR. The letter shall bear the seal and signature of the SIOR.
3. Verify qualifications of all special inspectors.
4. Verify the qualifications of all fabricators.
5. Develop the special inspection project manual. The special inspection project manual shall identify the specific special inspection requirements for the project and include the applicable directives from the registered design professional and the authority having jurisdiction. The special inspection project manual shall form the basis for the
preconstruction meeting and shall become a part of the construction documents. At the preconstruction meeting, all information in the special inspection project manual shall be reviewed to verify that all parties have a clear understanding of the special inspection provisions and the individual duties of each party.

6. Organize and preside over a special inspection meeting in which representatives of the authority having jurisdiction, Contractor, and the registered design professional in responsible charge shall sign the log-in sheet documenting their presence at said meeting. A copy of the special inspection project manual with the log-in sheet included shall be made available on the job site during construction.

7. Attend preconstruction meetings.

8. Create and maintain an up-to-date file (3-ring binder) containing special inspectors’ daily and bi-weekly reports and the special inspection project manual. This file shall be located in a conspicuous place in the project trailer/office to allow review by the building official and registered design professional in responsible charge.

9. Until all work requiring special inspection is complete, submit bi-weekly reports to the authority having jurisdiction and the registered design professional in responsible charge. A report is required for each bi-weekly period and shall include, at minimum:

   a. A brief summary of the work performed during the reporting time frame.
   b. Changes and/or discrepancies with the mechanical or electrical component certification, drawings, and specifications that were observed during the reporting period.
   c. Discrepancies which were resolved or corrected.
   d. A list of nonconforming items requiring resolution.
   e. All applicable test results.

10. When the work requiring special inspections is completed and all non-conforming items have been resolved to the satisfaction of the registered design professional in responsible charge, upon notification from the Contractor, the SIOR shall submit a final special inspection report to the authority having jurisdiction, the registered design professional in responsible charge, and the Contractor. The final special inspection report shall attest that special inspection has been performed on all work requiring special inspection and that all non-conforming work was resolved to the satisfaction of the design professional in responsible charge, the final special inspection report shall be signed, dated, and bear the professional seal of the SIOR.

1.3 INFORMATIONAL SUBMITTALS

A. Contractor's statement of responsibility: when required by authorities having jurisdiction, submit copy of written statement of responsibility sent to Contracting Officer and the authorities having jurisdiction before starting work on the following systems. The Contractor’s statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the Statement and Schedule of Special Inspections.

1. Seismic-force-resisting system, designated seismic system, or components noted in the Statement and Schedule of Special Inspections.
2. Main wind-force-resisting system or a wind-resisting components noted in the Statement and Schedule of Special Inspections.

B. Testing agency qualifications: for testing agencies specified 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.

C. Special inspector qualifications: the special inspector shall provide written documentation to the Contracting Officer and authorities having jurisdiction demonstrating their competence and relevant experience or training. Comply with IBC requirements.

D. Submittals to the Building Official/Authorities Having Jurisdiction.
In addition to the submittal of reports of special inspections and tests, submit reports and certificates to the Contracting Officer and authorities having jurisdiction.

1. Certificates of compliance for the following: fabrication of structural members, seismic qualifications of nonstructural components, designated seismic systems, open web steel joists and girders, material property compliance with AWS and ACI, mil tests for reinforcing bars in seismic systems. Reference IBC 1704.5 for additional information.

1.4 REPORTS AND DOCUMENTS SUBMITTALS

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. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the Contracting Officer and authorities having jurisdiction prior to the completion of that phase of the work.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.
14. Corrections of any discrepancies noted.
15. General progress of the work.
16. Note any significant construction loading on completed floors, members, or walls.
17. The date and time of mixing, quantity, proportions of material used, approximate placement location in the structure, and results of tests for fresh and hardened concrete properties for all concrete mixtures used in the work.

18. Concrete temperatures and protection given to concrete during placement and curing when the ambient temperature falls below 40 degree F or rises above 95 degrees F.

B. Manufacturer's field reports: prepare written information documenting tests and inspections specified in other sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual specification sections.

C. Permits, licenses, and certificates: 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.

1.5 SPECIAL INSPECTOR

A. Use a special inspector to perform special inspections required by this section. The special inspector is a person employed by the Contractor and approved by the authorities having jurisdiction as being qualified by knowledge and experience to perform the special inspection for the category of work being constructed. Special inspectors shall perform their duties independent from the construction quality control staff employed by the Contractor. More than one special inspector may be required to provide the varied knowledge and experience necessary to adequately inspect all of the categories of work requiring special inspection.

1.6 SPECIAL TESTS AND INSPECTIONS

A. Special tests and inspections: Engage a qualified testing agency and special inspector to conduct special tests and inspections required, as indicated in this section.

B. Special tests and inspections: conducted by a qualified testing agency and special inspector as indicated in individual specification sections, as indicated in this section, and as follows:

1. Verify that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the work.
2. Notify Contracting Officer, construction manager, and Contractor promptly of irregularities and deficiencies observed in the work during performance of its services.
3. Submit a certified written report of each test, inspection, and similar quality-control service to Contracting Officer, with copy to Contractor and to authorities having jurisdiction.

4. Submit a final report of special tests and inspections at substantial completion, which includes a list of unresolved deficiencies to Contracting Officer, with copy to Contractor and to authorities having jurisdiction.

5. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the contract documents.

6. Retest and re-inspect corrected work.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 SCHEDULE OF SPECIAL OF INSPECTIONS

A. Soils:

1. Periodically verify materials below shallow footings are adequate to achieve the design bearing capacity.
2. Periodically verify excavations are extended to proper depth and have reached proper material.
3. Periodically perform classifications and testing of compacted fill materials.
4. Continuously verify use of proper materials, densities, and lift thicknesses during placement and compaction of compacted fill.
5. Periodically inspect, prior to placement of compacted fill, subgrade and verify that site has been prepared properly.

B. Concrete Construction:

1. Periodically inspect reinforcing steel, including prestressing tendons (if applicable), and verify placement.
2. Periodically inspect welding of reinforcing bars for weldability other than ASTM A 706 and inspect single pass fillet welds (maximum of 5/16”). Continuously inspect all other welds.
3. Continuously inspect bolts to be installed in concrete prior to and during placement of concrete.
4. Periodically verify use of required design mix.
5. Prior to concrete placement, fabricate specimens for strength test, continuously perform slump and air content tests, and determine the temperature of the concrete.
6. Continuously inspect concrete placement for proper application techniques.
7. Periodically verify maintenance of specified curing temperature and techniques.
8. Periodically inspect formwork for shape, location and dimensions of the concrete members being formed including removal of forms and reshoring.
9. Periodically inspect post installed anchor types, dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distance, anchor embedment, and tightening/torque.
10. Continuously inspect adhesive anchors in horizontal or upwardly inclined orientation to resist sustained tension loads.
11. Periodically inspect placement of embedments.

C. Masonry Construction-Level B Inspection:

1. Periodically verify slump flow and visual stability index (VSI) as delivered to the site for self-consolidating grout.
2. Periodically verify masonry net area compressive strength (f’m) prior to construction.
3. Periodically verify compliance with required inspection provisions of the construction document and the approved submittals.
4. Periodically inspect proportions of site prepared mortar, construction of mortar joints, location of reinforcement and connectors.
5. Periodically inspect grout space prior to grouting.
6. Periodically inspect grade, type, size of reinforcement and anchor bolts.
7. Periodically inspect placement of reinforcement, connectors.
8. Periodically inspect site prepared grout.
9. Periodically inspect construction of mortar joints.
11. Periodically inspect type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
12. Continuously inspect welding of reinforcing bars.
13. Periodically inspect preparation, construction, and protection of masonry during cold weather (temperature below 40 degrees F.) or hot weather (temperatures above 90 degrees F.).
14. Periodically inspect grout space, grout placement to ensure compliance with code and construction document provisions.
15. Periodically verify the preparations of any required grout specimens, mortar specimens and/or prisms.

D. Open-Web Steel Joists and Joist Girders

1. Periodic inspection of installation of joists and joist girders:

   a. End connections and field-splice connections (welded or bolted).
   b. Bridging (horizontal or diagonal). Standard bridging and bridging that differs from SJI specifications.

E. Steel Construction
1. Welds (Tables N5.4-1 through N5.4-3, AISC 360-10) Continuously verify welding procedure specifications (WPS) available.
   a. Continuously verify manufacturer certifications for welding consumables.
   b. Periodically perform material identification (type/grade)
   c. Periodically verify welder identification system.
   d. Periodically verify fit-up of groove welds (including joint geometry) for the following aspects: joint preparation, dimensions (alignment, root opening, root face, bevel), cleanliness (condition of steel surfaces), tacking (tack weld quality and location, backing type and fit (if applicable).
   e. Periodically verify configuration and finish of access holes.
   f. Periodically verify fit-up of fillet welds for the following aspects: dimensions (alignment, gaps at root), cleanliness (condition of steel surfaces), tacking (tack weld quality and location).
   g. Periodically verify use of qualified welders.
   h. Periodically inspect packaging and exposure control of welding consumables.
   i. Periodically verify no welding is done over cracked tack welds.
   j. Periodically verify wind speed, precipitation, and temperature is within environmental condition limits.
   k. Periodically verify WPS are followed: settings on welding equipment, travel speed, selected welding materials, shielding gas type/flow rate, preheat applied, interpass temperature maintained (min./max.), proper position (F, V, H, OH).
   l. Periodically verify the following welding techniques: interpass and final cleaning, each pass within profile limitations, each pass meets quality requirements.
   m. Periodically verify welds are cleaned.
   n. Continuously inspect size, length, and location of welds.
   o. Continuously verify welds meet the following acceptance criteria: crack prohibition, weld/base-metal fusion, crater cross section, weld profiles, weld size, undercut, and porosity.
   p. Continuously inspect arc strikes.
   q. Continuously inspect k-area.
   r. Continuously verify backing removed and weld tabs are removed (if required).
   s. Continuously inspect repair activities.
   t. Continuously document acceptance or rejection of welded joint or member.

4. Bolts (Tables N5.6-1 through N5.6-3, AISC 360-10):
   a. Continuously verify manufacturer’s certifications available for fastener materials.
   b. Periodically inspect fasteners marked in accordance with ASTM requirements.
   c. Periodically verify proper fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane).
   d. Periodically verify proper bolting procedure selected for joint detail.
   e. Periodically verify connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements.
   f. Periodically inspect pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used.
   g. Periodically inspect proper storage provided for bolts, nuts, washers and other fastener components.
Periodically verify fastener assemblies, of suitable condition, placed in all holes and washers (if required) are positioned as required.

Periodically verify joint brought to the snug-tight condition prior to the pre-tensioning operation.

Periodically verify fastener component not turned by the wrench prevented from rotating.

Periodically verify fasteners are pre-tensioned in accordance with the RCSC specification, progressing systematically from the most rigid point toward the free edges.

Continuously verify and document acceptance or rejection of bolted connections.

5. Nondestructive Testing (NDT) of Welded Joints

a. Ultrasonic testing shall be performed on all CJP groove welds in materials 5/16” thick or greater.

b. Welded joints subject to fatigue: Radiographic or Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue.

d. k-Area NDT: Where welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the k-area base metal within 3-inches of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.

d. Beam cope and access holes: At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 1 1/2 in. for rolled shapes, or when the web thickness exceeds 1 1/2 in. for built-up shapes.

e. Periodically verify placement of reinforcing or contouring fill welds.

6. Composite Structures AISC 341-10 (Tables J9-1 through J9-3, AISC 341-10) and (Table N6.1, AISC 360-10)

a. Periodically verify material identification of reinforcing steel (type/grade).

b. Periodically verify determination of carbon equivalent for reinforcing steel other than ASTM A706.

c. Periodically verify proper reinforcing steel size, spacing and orientation.

d. Periodically verify reinforcing steel has not been rebent in the field.

e. Periodically verify reinforcing steel has been tied and supported as required.

f. Periodically verify required reinforcing steel clearances have been provided.

g. Periodically verify composite member has required size.

h. Periodically perform material identification (mix design, compressive strength, maximum large aggregate size, maximum slump).

i. Periodically verify limits on water added at the truck or pump.

j. Periodically verify proper placement techniques are used to limit segregation.

k. Document achievement of minimum specified concrete compressive strength at specified age.

l. Continuously inspect placement and installation of steel deck.
m. Continuously inspect placement and installation of steel headed stud anchors.

n. Document acceptance or rejection of steel elements.

7. Other Steel Structure Inspections (Table J8-1, AISC 341-10)

a. Continuously inspect anchor rods and other embedments supporting structural steel. Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.

b. Periodically inspect fabricated steel or erected steel frame. Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.

8. Cold-Formed Steel Decks

a. Continuously verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness

b. Continuously document acceptance or rejection of deck and deck accessories.

c. Continuously verify compliance of deck and all deck accessories installation with construction documents

d. Continuously verify deck materials are represented by the mill certifications that comply with the construction documents

e. Continuously document acceptance or rejection of installation of deck and deck accessories

f. Periodically inspect welding procedure specification (WPS) available.

g. Periodically inspect manufactures certifications for welding consumables available.

h. Periodically verify material identification (type/grade).

i. Periodically check welding equipment.

9. Cold-Formed Steel Deck Welding

a. Periodically verify use of qualified welders.

b. Periodically verify control and handling of welding consumables.

c. Periodically verify environmental conditions (wind speed, moisture, temperature).

d. Periodically verify WPS followed.

e. Continuously verify size and location of welds, including support, sidelap, and perimeter welds.

f. Continuously inspect welds meet visual acceptance criteria.

g. Continuously verify repair activities.

h. Continuously document acceptance or rejection of welds.

10. Cold-Formed Steel Deck Fastening

a. Periodically inspect manufacturer installation instructions available for mechanical fasteners.

b. Periodically inspect proper tools available for fastener installation.

c. Periodically inspect fasteners are positioned as required.
d. Periodically inspect fasteners are installed in accordance with manufacturer's instructions.
e. Continuously check spacing, type, and installation of support fasteners.
f. Continuously check spacing, type, and installation of sidelap fasteners.
g. Continuously check spacing, type, and installation of perimeter fasteners.
h. Continuously verify repair activities.
i. Continuously document acceptance or rejection of mechanical fasteners.

11. Fabrication:

a. Periodically verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator’s ability to conform to approved construction documents and referenced standards. Review the procedures for completeness and adequacy relative to the code requirements for the fabricator’s scope of work.

b. Inspection of fabricators, in note 1 above, shall not be required where the fabricator’s work is done on the premises of a fabricator registered and approved to perform such work without special inspections. Approval shall be based upon review of the fabricators written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the Contracting Officer stating that the work was performed in accordance with the approved construction documents.

F. Cold-formed metal framing:

1. Periodically inspect wall framing (interior and exterior) during erection and fastening for walls greater than 30 feet height.

G. Wind Resisting Components:

1. Periodically inspect roof covering, roof deck, and roof framing connections.

2. Periodically inspect exterior wall covering and wall connections to roof and floor diaphragms and framing.

H. Fire Protection – Spray Fire-Resistant Materials:

1. Surface condition (periodic inspection):
   a. Prior to application confirm that surface has been prepared per the approved fire-resistance design and manufacturer’s instructions.

2. Application (periodic inspection):
a. Prior to application confirm that the substrate meets the minimum ambient temperature per the approved fire-resistance design and manufacturer’s instructions.

3. Material thickness (periodic inspection):
   a. Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more that 10 percent of the measurement, but in no case less than minimum allowable thickness required by IBC 1705.14.

4. Material density (periodic inspection):
   a. Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more than 10 percent of the measurement, but in no case less than minimum allowable thickness required by IBC 1705.14.5

5. Bond strength (periodic inspection):
   a. Verify cohesive/adhesive bond strength of the cured SFRM applied to the structural element is not less than 150psf and according to IBC 1705.14.6

I. Fire Protection – Mastic and Intumescent Coatings:

1. Surface Preparation (periodic inspection):
   a. Inspections shall be performed in accordance with AWCI 12-B and the contract documents.

J. Fire Protection – Fire Resistance Penetrations and Joints:

1. Periodic inspections of penetration firestop systems conducted in accordance with ASTM E 2174.
2. Periodic inspections of fire-resistant joint systems conducted in accordance with ASTM E 2393.

K. Fire Protection – Smoke Control:

1. Periodically verify device locations and perform leakage testing. Perform during erection of ductwork and prior to concealment
2. Periodically verify/inspect pressure difference testing, flow measurements and detection and control verification. Perform prior to occupancy and after sufficient completion

L. Architectural – Components:

1. Periodically inspect/verify erection and fastening of exterior cladding and interior and exterior veneer. Verify appropriate materials, fasteners and attachment at
commencement of work and at completion. Inspector Note: Inspection not required if height is less than 30 feet or weight is less than 5psf
2. Periodically inspect/verify Interior and exterior non-load bearing walls. Verify appropriate materials, fasteners and attachment at commencement of work and at completion. Inspector Note: Inspection not required if height is less than 30 feet. Also, Interior non-load bearing walls need not be inspected if weighing less than 15psf
3. Periodically inspect/verify access floors. Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report
4. Periodically inspect/verify storage racks. Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report. Inspector Note: Not required for racks less than 8 feet in height

M. Plumbing, Mechanical, and Electrical – Designated Seismic Systems

1. Designated Seismic Systems equipment verification (Periodic Inspection):
   a. Verify model number and serial number are in conformance with project specific seismic qualification (PSSQ)
   b. Verify Tag ID is correct and installed per specifications
2. Designated Seismic Systems equipment Mounting (Periodic Inspection)
   a. Verify that Anchor Base Bolting is installed per PSSQ
   b. Verify that Equipment Bracing is Installed per PSSQ
   c. Verify that Bracing Attachments are installed per PSSQ
3. Designated Seismic Systems utility Conduit/Piping (Periodic Inspection)
   a. Verify that Conduit/Piping is connected to the equipment per PSSQ (flex or rigid)
   b. Verify that Conduit/Piping is seismically supported independently of equipment and in accordance with PSSQ support requirements
4. Designated Seismic Systems clearance (Periodic Inspection)
   a. Adjacent Equipment – Verify that there is adequate gap to eliminate possibility of pounding
   b. Conduit/Piping - Verify that there is adequate gap to eliminate possibility of pounding.
5. In addition to IBC Chapter 17 requirements, this project is classified as either Seismic Design Category C (Hangar & Simulator buildings) or Seismic Design Category D (Fire Pump House building) per UFC 3-301-01 and ASCE 7-10, the following applies to particular Mechanical, Electrical, Plumbing, and Fire Protection systems, such system requires seismic bracing and Special Inspections:
a. The component is required to function for life-safety purposes after an earthquake, including fire protection sprinkler systems and egress stairways.
b. The component conveys, supports, or otherwise contains toxic, highly toxic, or explosive substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released.
c. The component is in or attached to a Risk Category IV structure (Fire Pump House building) and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
d. The component conveys, supports, or otherwise contains hazardous substances and is attached to a structure or portion thereof classified by the authority having jurisdiction as a hazardous occupancy.

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 Contracting Officer.
   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 Contracting Officer’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.

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 01 45 35
SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 definitions

A. Permanent Enclosure: As determined by Contracting Officer, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction closures.

1.3 USE CHARGES

A. General: Allow other entities to use temporary services and facilities without cost, including, but not limited to, Government's representatives and SIOH (Supervision, Inspection and Overhead) personnel, occupants of Project, testing agencies, and others as necessary to complete the Work.

B. Sewer Service: Contractor is able to tie into the sewer line for their construction trailer if one is available at the Site. If one is not available, it is up to the Contractor to pay for the connection if they want to use the sewer service.

C. Gas Service: Gas Service from Government's existing system is available for use. Metering and payment of use charges is not required. Provide connections and extensions of services as required for construction operations per the Government’s and per the local Gas Authority’s requirements and pay for all permitting, tapping, inspection, or approval fees. Upon completion of the project, remove the connections, extensions, and restore the services and disturbed areas to original conditions.

D. Water Service: Water from Government's existing water system is available for use. Metering and payment of use charges is not required. Provide connections and extensions of services as required for construction operations per the Government’s and per the local Water Utility Authority’s requirements and pay for all permitting, tapping, inspection, or approval fees. Upon completion of the project, remove the connections, extensions, and restore the services and disturbed areas to original conditions.

E. Electric Power Service: Temporary Electric power for construction purposes from Government's existing system is available for use. Metering and payment of use charges is not required. Provide connections and extensions of services as required for construction operations per the Government’s and per the local Power Authority’s requirements and pay for
all permitting, tapping, inspection, or approval fees. Upon completion of the project, remove the connections, extensions, and restore the services and disturbed areas to original conditions.

1.4 SUBMITTALS

A. Site Plan: provide an annotated Site Plan showing temporary facilities, utility hookups, staging areas, and parking areas for construction personnel for Government review and approval 2 weeks prior to mobilization.

1.5 QUALITY ASSURANCE

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

B. Tests and Inspections: Arrange for testing and inspection of each temporary utility before use, as required. Obtain and pay for required certifications and permits, if required.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS


2.2 TEMPORARY FACILITIES

A. Contractor-Use Field Office: Contractor shall provide and maintain Contractor temporary facilities as required.

B. Government-Use Field Office: Of sufficient size to accommodate needs of construction personnel, and one lockable enclosed office for the Government’s onsite representative. Keep offices clean and orderly. Furnish and equipment in field offices as follows:
1. Furniture required for Project-site documents including file cabinets, a plan table, a plan rack, and a bookcase.
2. Provide 2 private offices for use by the Government. Furnish a desk, chair, and file cabinet in the enclosed offices (within the trailer) for the Government’s onsite representatives.
3. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and two, 30” x48” tack & dry erase marker boards.
4. Drinking water and private toilet.
5. Coffee machine and supplies.
6. Cooling and heating equipment necessary to maintain a uniform indoor temperature of 68-deg F to 72-deg F in all spaces within all spaces of the trailer.
7. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
8. Provide telephone and ‘high-speed’ internet connectivity capability within offices and conference room.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

2.3 EQUIPMENT

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

B. HVAC Equipment: Provide vented, self-contained AC unit for Field office with individual space thermostatic control. Also provide vented, self-contained liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to the Contracting Officer, and marked for intended use.
   3. Permanent HVAC System: the permanent building HVAC system shall not be used for temporary use during construction by the Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work. Location, modification and relocation of the facilities shall be approved by the Government.
B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service.

1. Arrange with utility company, Government, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction at the Contractor’s expense. Coordinate with the Government and local Water Authority and pay all permit, tapping, and inspection fees.

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

D. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities, in accordance with SMACNA IAQ guidelines, for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient conditions required and minimize energy consumption.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Coordinate with local Power Authority and Government for connection to existing power.

1. Install electric power service underground, unless otherwise indicated.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

2. Install lighting for Project identification sign.

H. Telephone Service: Provide temporary telephone service in field office facilities for use by all construction personnel. Contractor shall pay the temporary telephone services. Install one telephone line for the field office.

1. Provide additional telephone lines for the following:
a. Provide a dedicated telephone line for each facsimile machine and computer in the field office.

2. At the telephone location, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Architect/Engineers' office
   e. Contracting Officer's and Contracting Officer’s Representative’s office.
   f. Principal subcontractors' field and home offices.
   g. Key Charlotte Douglas ANGB Representatives

3. Provide superintendent with the most efficient portable communication device(s) to meet operational needs.

I. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in field office facilities. Contractor shall pay the temporary Electronic Communication services.
   1. Provide ‘high-speed’ internet service in field offices and conference rooms.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
   2. Maintain support facilities until near Contract Completion or as otherwise directed by the Contracting Officer (CO). Remove before Final Completion and Acceptance by the Contracting Officer.

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

C. Traffic Controls: Comply with requirements as directed by the Contracting Officer or Contracting Officer’s representative.
   1. Protect existing site improvements to remain including curbs, pavement, retaining walls, and utilities.
   2. Protect existing trees designated to remain as indicated in the Contract Documents.

D. Parking: Provide temporary parking areas for construction personnel.
E. Dewatering Facilities and Drains: Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
   2. Maintain all sediment and erosion control measures so that they are fully functional.

F. Project Identification and Temporary Signs: Provide Project identification. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted. Coordinate with the CO.
   1. Provide temporary, directional signs for construction personnel and visitors.
   2. Maintain and touchup signs so they are legible at all times.


H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with all state and local requirements.

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

J. Temporary Stairs: Provide temporary stairs/steps where ladders are not adequate.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution, increased discharge, or other undesirable effects onsite, and also so that all adjacent properties are not adversely impacted.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties, public roadways, waterways, and walkways, so as to meet all federal, state, and local requirements.
   1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Stormwater Control: Comply with all federal, state and local requirements. Provide barriers and erosion control measures in and around excavations, subgrade construction, and for all disturbed areas, to prevent flooding by runoff of stormwater from heavy rains.
D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Historic Structure/Ruins Protection: It is not anticipated that any historic ruins/structures will be discovered within the limits of disturbance for this project. However, if any such items (or suspected such items) are discovered during site work operations, notify the Contracting Officer or Contracting Officer’s representative prior to removing such items from the site.

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

G. Site Enclosure Fence: Before construction operations begin furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide the CO with one set of keys.

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

I. Barricades, Warning Signs, and Lights: Comply with all federal, state and local requirements for erecting structurally adequate barricades, including warning signs and lighting.


   1. Prohibit smoking in hazardous fire-exposure areas and within all permanent closures.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to all federal, state and local requirements.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

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

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until acceptable to the CO.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or as approved by the CO. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

   1. Materials and facilities that constitute temporary facilities are property of Contractor. Government reserves right to take possession of Project identification signs.

   2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by the Contracting Officer.

   3. Before Completion and as coordinated with the CO, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00, "Closeout Procedures."

END OF SECTION 01 50 00
SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, which is current as of date of the Contract Documents.

2. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract and proposed by Contractor.

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

1.3 SUBMITTALS

A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.

2. Form: Tabulate information for each product under the following column headings:

   a. Specification Section number and title.
   b. Generic name used in the Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 4 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
   a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 4 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.

5. Contracting Officer's Action: Contracting Officer will respond in writing to Contractor within 15 working days of receipt of completed product list. Contracting Officer's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Contracting Officer's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract.

B. Substitution Requests: Submit three copies of each request for consideration to the Contracting Officer. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A or other as directed by Contracting Officer.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications, needed to other parts of the Work and to construction performed by Government and separate contractors that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and Governments or others.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to the Contracting Officer.

i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time of Performance. If specified product or method of construction cannot be provided within the Contract Time of Performance, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

j. Cost information, including a proposal of change, if any, in the Contract Sum.

k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Contracting Officer's Action: If necessary, Contracting Officer will request additional information or documentation for evaluation within 10 working days of receipt of a request for substitution. Contracting Officer will notify Contractor of acceptance or rejection of proposed substitution within 15 working days of receipt of request, or 10 working days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Approval of Submittal

b. Use product specified if Contracting Officer cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Contracting Officer's Action: If necessary, Contracting Officer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Contracting Officer will notify Contractor of approval or rejection of proposed comparable product request within 15 working days of receipt of request, or 10 working days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 01 33 00, "Submittal Procedures."

b. Use product specified if Contracting Officer cannot make a decision on use of a comparable product request within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Contractor is responsible to insure that each subcontractor, at any tier, 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, Contracting Officer will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weather-tight enclosure above ground, with ventilation adequate to prevent condensation or mold development.
   4. Store cementitious products and materials on elevated platforms.
   5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Government.
   2. Special Warranty: Written warranty required by or incorporated into the Contract, either to extend time limit provided by manufacturer's warranty or to provide more rights for Government.
B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer’s Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 44 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00, "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products in accordance with "Clause Buy American Act – Construction Materials."
2. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
3. 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.
4. Government reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract.
5. Where products are accompanied by the term "as selected," Contracting Officer will make selection.
6. Where products are accompanied by the term "match sample," sample to be matched is Contracting Officer's.
8. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Article 2 "Comparable Products", to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. **Acceptable Products:** Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products", for consideration of an unnamed product.

6. **Acceptable Manufacturers:** Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products", for consideration of an unnamed product.

7. **Product Options:** Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions", for consideration of an unnamed product or system.

8. **Basis-of-Design Product:** Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products", for consideration of an unnamed product by the other named manufacturers.

9. **Visual Matching Specification:** Where Specifications require matching an established Sample, select a product that complies with requirements and matches Government's sample. Contracting Officer's decision will be final on whether a proposed product matches.

   a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions", for proposal of product.

10. **Visual Selection Specification:** Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. **Standard Range:** Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Contracting Officer will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.

    b. **Full Range:** Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Contracting Officer will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

### 2.2 PRODUCT SUBSTITUTIONS

#### A. Timing: Contracting Officer will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Contracting Officer.

#### B. Conditions: Contracting Officer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Contracting
Officer. will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Government a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Government must assume. Government's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Government, and similar considerations.

2. Requested substitution does not require extensive revisions to the Contract.

3. Requested substitution is consistent with the Contract and will produce indicated results.

4. Substitution request is fully documented and properly submitted.

5. Requested substitution will not adversely affect Contractor's Construction Schedule.

6. Requested substitution has received necessary approvals.

7. Requested substitution is compatible with other portions of the Work.

8. Requested substitution has been coordinated with other portions of the Work.

9. Requested substitution provides specified warranty.

10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and won’t cause any issues with any contractors at any tier in terms of contract price, quality or time of performance.

2.3 COMPARABLE PRODUCTS

A. Conditions: Contracting Officer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Contracting Officer will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract, that it is consistent with the Contract 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 Government personnel, if requested.

5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00
SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS

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

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

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Products: List products to be used and firms or entities that will perform the Work.
3. Dates: Indicate when cutting and patching will be performed.
4. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
5. Contracting Officer's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. 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. Operating elements include the following:

1. Primary building operational systems and equipment.
2. Control systems.
3. Communication systems.
4. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related 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. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior window-wall and structured-polycarbonate panel construction.
4. Piping, ductwork, vessels, and equipment.

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

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

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. In-Place Materials: Use materials 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 match the visual and functional performance of in-place materials.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. 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.

C. 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.

3.3 PERFORMANCE

A. 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. 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 as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Proceed with patching after construction operations requiring cutting are complete.

C. 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 possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate 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 eliminate 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.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29
SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 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.

1.2 DEFINITIONS

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

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

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

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

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

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

1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of at least 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, including, but not limited to the following:

   1. Demolition Waste:
      a. Asphalt paving.
      b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
e. Sprinklers.
f. Mechanical equipment.
g. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
7) Plastic pails.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 15 days of date established for the Notice to Proceed.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use the LEED Online template for Materials and Resources, Credit 2 for construction and demolition waste. Alternative form may be used if approved prior to submission. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons
4. Quantity of waste salvaged, both estimated and actual in tons
5. Quantity of waste recycled, both estimated and actual in tons
6. Total quantity of waste recovered (salvaged plus recycled) in tons
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. LEED Submittal: LEED letter template for Credit MR 2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

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.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator. Waste management coordinator may also serve as 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.
1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E1609 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 site-clearing and construction waste generated by the Work. Use the LEED Online template for Materials and Resources, Credit 2 for construction and demolition waste. Include estimated quantities and assumptions for estimates. Alternative form may be used if approved prior to submission.

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 the LEED Online template for Materials and Resources, Credit 2 for construction and 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. Alternative form may be used if approved prior to submission.

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 the LEED Online template for Materials and Resources, Credit 2 for construction and demolition waste. Alternative form may be used if approved prior to submission. 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.
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 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 Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Government's Use: Salvage items for Government'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 Government.
   4. Transport items to Government's storage area designated by Government.
   5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. 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 Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Government and Contractor.

C. 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.

D. 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 Government'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 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 4-inch 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 4-inch size.
   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 and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet and pad 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.
   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 Government'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 Government's property.

E. Disposal: Remove waste materials from Government's property and legally dispose of them.

END OF SECTION 01 74 19
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:

1. Section 01 78 39, "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
2. Section 01 78 23, "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 01 79 00, "Demonstration and Training" for requirements for instructing Government's personnel.
4. Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 CORRECTIVE ISSUES REPORT LOG

A. The Cx Authority will document deficiencies discovered during the commissioning process of systems on a Corrective Issues Log. The Cx Authority will then forward this form to the Contractor for action in correcting the deficiency.

B. When the deficiency has been corrected, the Contractor shall note action taken and return the Corrective Issue Report to the Commissioning Authority.

C. Corrective Issue Reports must be completed as a pre-requisite for Substantial Completion.

1.3 PRE-FINAL COMPLETION INSPECTION

A. Preliminary Procedures: Before requesting inspection for determining date of Final Completion, complete the following. List items below that are incomplete in request.

1. Deficiencies and Omissions List: Prepare a list of items to be completed and corrected, the value of items on the list, and reasons why the Work is not complete.
2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
3. Obtain and submit releases permitting Government unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

4. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.

5. Deliver tools, spare parts, extra materials, and similar items to location designated by the CO. Label with manufacturer's name and model number where applicable.

6. All the keying of new locks shall be done by the Contractor. All new construction cores and blank keys shall be sent to: The North Carolina Air National Guard Contracting Officer. Contractor may use construction cores during construction.

7. Complete startup testing of systems.

8. Submit test/adjust/balance records to Contracting Officer.

9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

10. Advise the CO of changeover in utilities.

11. Submit changeover information related to Government's occupancy, use, operation, and maintenance.

12. Complete final cleaning requirements, including touchup painting.

13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Final Completion, to the Contracting Officer, in sufficient time to allow all corrections to be made prior to the specified contract completion date. On receipt of request, Contracting Officer will either proceed with inspection or notify Contractor of unfulfilled requirements. Contracting Officer (CO) will prepare the Notice of Final Completion and Acceptance after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Contracting Officer (CO), that must be completed or corrected before Final Acceptance will be made.

1. Re-inspection: Request re-inspection 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.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit list of items to be completed or corrected, endorsed and dated by the Contracting Officer. The list shall state that each item has been completed or otherwise resolved for acceptance.

2. Submit pest-control final inspection report and warranty.

3. Instruct Government personnel in operation, adjustment, and maintenance of products, equipment, and systems.
B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Contracting Officer will either proceed with inspection or notify Contractor of unfulfilled requirements. Contractor shall submit a Final Application for Payment only after receiving notification from the Contracting Officer that the project is 100 percent acceptable.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies 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. Use CSI Form 14.1A, (see attached sample), or provide similar form approved by Contracting Officer.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Contracting Officer.
   d. Name of Architect.
   e. Name of Contractor.
   f. Page number.

B. The Punch List may not be all-inclusive, and the failure to include any items on this list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

1.6 GOVERNMENT PERSONNEL TRAINING

A. All training sessions shall be coordinated through the Cx Authority. The Cx Authority will prepare a Training Form for each training session required by the contract documents and issue to the contractor. The training forms shall be used to schedule, perform and document the required training sessions.

B. After each Training session is completed, The Cx Authority will issue and Evaluation Form to each of the Attendees. This feedback information will be provided to the Government for review.

C. Refer to Section 01 79 00 "Demonstration and Training" for Government training requirements.
1.7 WARRANTIES

A. Submittal Time: Submit written warranties to Contracting Officer (CO) for designated portions of the Work where commencement of warranties other than date of Final Completion is indicated as acceptance by the Contracting Officer.

B. Use and Possession Prior to Completion: (reference applicable contract clause and use that terminology) Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Government during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide 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 of entire Project or a portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

   d. Remove tools, construction equipment, machinery, and surplus material from Project site.

   e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

   f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, and similar spaces.

   g. Sweep concrete floors broom clean in unoccupied spaces.

   h. Vacuum soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

   i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

   j. Remove labels that are not permanent.

   k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

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

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

   m. Replace parts subject to unusual operating conditions.

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

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

   p. Clean ducts, blowers, and coils if units were operated without filters during construction.

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

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

END OF SECTION 01 77 00
SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Sections:

1. Section 01 33 00, "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Section 01 91 13, "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
3. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 DEFINITIONS

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

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

C. CO: Contracting Officer.

1.3 LEED SUBMITTALS

A. Credit EQ 3.1: Provide documentation showing implementation of Facility In-Use Indoor Air Quality (IAQ) plan to insure effective management of facility air quality during building life. Plan to include: Education of occupants and facility managers on indoor pollutants with prevention roles; permanent monitoring of supply and return air, fresh air intake, for carbon monoxide, carbon dioxide, total VOC's and particulates.
1.4 SUBMITTAL SCHEDULE

A. Submittal Schedule: Unless otherwise noted, comply with the following schedule for submitting operation and maintenance manuals. All O&M submittals shall be manufacturer’s original publications. Photocopies will not be accepted:

1. Draft O&M Documentation for Individual Items. Thirty days after approval of each technical submittal, submit 2 draft sets of O&M documentation for the approved item to the CO and the CxA for review. The CxA will review O&M documentation and shop drawings within the same review period as the CO. The CxA will review the O&M documentation for Cx process related information and issue review comments directly to the CO. The CO will return 1 copy of the draft with comments within 30 days of receipt.

2. Inventory Information. Submit 2 paper copies and one electronic version in MS Excel format 90 days before substantial completion.

3. Final O&M Documentation. Submit 1 paper copy and one electronic version of final complete O&M documentation 90 days before final completion. Manuals shall be organized by specification section. Each section shall be in its own set of binders. The CO will return the paper copy with comments within 30 days of receipt. Make corrections or modifications to comply with the CO’s comments. Submit 5 paper sets of the final O&M documentation to the CO within 30 days of receipt of the CO’s comments.

B. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by the Government’s operating personnel. Organize into sets in sizes as indicated. Organize O&M information by system in the systems Schedule.

1. Binders: For each paper manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, maximum of 3 inches thick, sized to receive 8-1/2-by-11-inch paper. Provide a clear plastic sleeve on the spine and front cover to hold labels describing contents. Provide 3-hole punched, heavy-duty sheet protectors to hold folded oversized documents. Do not fill binders to more than 1/2 capacity.

   a. Where multiple binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.

   b. Identify each binder on front and spine, with the printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.

2. Dividers: Provide heavy paper dividers with clear celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a description of the Product and major parts of equipment included in the Section on each divider.

3. Text Material: Provide the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, computer generated, on 8-1/2-by-11 inch, 20-lb/sq. ft. white bond paper.

4. Drawings: Provide reinforced, punched binder tabs on drawings and bind with text. Where oversize drawings are necessary, fold drawings to the same size as text pages, and inserted in a 3-hole-punched, heavy-duty plastic sheet protector.

C. Payment Deduction: Timely submission of O&M documentation is critical to successful commissioning and turnover of O&M documentation to the Government. For O&M documentation not submitted in accordance with the submission schedule listed here in, the Government will utilize services from others to obtain the required O&M information. The contractor’s price will be reduced by an amount commensurate with the cost to the government to obtain the required information by alternate means.

1.5 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. Where applicable, clarify and update reviewed manual content to correspond to modifications 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 Contracting Officer.
   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. CO, 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. CO and Commissioning Agent 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. CO and Commissioning Agent will return copy with comments.

1. Correct or modify each manual to comply with CO's and Commissioning Agent's comments. Submit copies of each corrected manual within 15 days of receipt of CO’s and Commissioning Agent's comments and prior to commencing demonstration and training.
PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: 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.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Government.
   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 Agent.
   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 upon 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 upon 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, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. 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, 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.


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.
   5. Power failure.
   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 Government'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:
2. Performance and design criteria if Contractor is 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.
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.
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 Government'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 Government'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 01 78 39, "Project Record Documents."

G. Comply with Section 01 77 00, "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23
SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit two sets of marked-up Record Prints.
2. Number of Copies: Submit copies of Record Drawings as follows:
   a. Initial Submittal: Submit two sets of corrected Record Transparencies for Construction Documents. Contracting Officer’s Representative will initial and date each transparency and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Contracting Officer’s Representative will return transparencies and prints for organizing into sets, printing, binding, and final submittal.
   b. Final Submittal: Submit two sets of marked-up Record Prints for Construction Documents.

B. Record Specifications: Submit two copies of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit two copies of each Product Data submittal according to requirements of Part 2 of this Section.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings.

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 prepare the 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 understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

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 Contract Change Order/Modification.

k. Changes made following Contracting Officer'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 to show actual physical conditions, completely and accurately.

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 Transparencies: Immediately before Final Inspection, review marked-up Record Prints with the Contracting Officer. When authorized, prepare a full set of corrected transparencies of the Shop Drawings.

1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.

2. Refer instances of uncertainty to Contracting Officer for resolution.

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

1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Transparencies for the Shop Drawings: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.

3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect and Engineer.
   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 and Record Drawings where applicable.

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.

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. Submit completed DD Form 1354 (sample attached) to the Contracting Officer.
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 modifications to Project Record Documents as they occur during construction; do not wait until the 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 Contracting Officer (CO)’s reference during normal working hours.

END OF SECTION 01 78 39
SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Government 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. Written documentation of training and Government personnel comprehension.

1.2 SUBMITTALS

A. Instruction Program: 90 days prior to substantial completion, submit three copies of instructional program outlines for demonstration and training, including a schedule of proposed dates, times, length of instruction time, instructors’ names and instructors’ qualifications for each training module. Include learning objective and outline for each training module. Instruction program shall be based upon and utilize the approved operation and maintenance manual data.

   1. At completion of training, submit one complete training manual for the Government’s use.

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

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

D. Video: Provide training video for training sessions identified in Part 3 of this Section.

E. Qualifications: Provide as specified in Paragraph 1.3 Quality Assurance below.

1.3 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 technician experienced in operation and maintenance procedures and training.
C. Video-Photographer Qualifications: Individual or firm experienced in professional video photography and editing. Provide name, address and list of projects completed.

D. Pre-instruction Conference: Conduct conference at Project site. 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 including classroom training and field training.
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.

1.4 COORDINATION

A. Coordinate instruction schedule with Government operations. Adjust schedule as required to minimize disrupting Government operations.

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 operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved.

D. The Commissioning Authority (CxA) will review the proposed Instruction Program with the Contracting Officer. If the submitted information is complete and the proposed dates meet the Government’s Operations Personnel schedule, the CxA will respond to the Contractor to proceed with scheduling the subject training session.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop a comprehensive instruction program. Include individual training modules for each system and equipment not part of a system, as required by technical Specification Sections and the Schedule of Training in Part 3 of this Section.

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:

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:
   b. Maintenance manuals.
   c. Project Record Documents.
   d. Identification systems.
   e. Warranties and bonds.
   f. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following:
   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:
   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, including lockout/tag out requirements.
   g. Instructions on stopping.
   h. Normal shutdown and re-start instructions.
   i. Operating procedures for system, subsystem, or equipment failure.
   j. Seasonal and weekend operating instructions.
   k. Required sequences for electric or electronic systems.
   l. 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/predictive maintenance.
   f. Procedures for routine maintenance.
   g. Recommended intervals for routine maintenance.
   h. 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 combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Qualified Facilitator shall prepare instruction program and training modules, to coordinate instructors, and coordinate between Contractor and Government for number of participants, instruction times, dates and location.

B. Qualified Instructors shall instruct Government personnel to adjust, operate, and maintain equipment and systems.

1. The Contracting Officer will furnish names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide instruction on actions necessary to prepare for and execute seasonal change over.

1. Schedule training through the Contracting Officer and Commissioning Authority with at least 30 days’ advance notice.
D. Evaluation: At the conclusion of each training module, assess and document training.

1. Assess and document each participant’s mastery of module by use of an oral performance-based test.
2. Obtain each participant’s evaluation of the training via a pre-printed survey form approved by the Contracting Officer and Commissioning Authority.

E. Video Recording: Provide video recording in CD format of training session identified in Schedule. Record each training module separately. Include classroom instructions, demonstrations, board diagrams, and other visual aids. Do not include student practice.

1. Video recording shall be pre-planned and coordinated for each training session.
2. Video recording shall be scripted and edited to ensure all teaching points are covered in a systematic manner.
3. At beginning of each training module, record each chart containing learning objectives and lesson outline.

F. Cleanup: Collect used and leftover educational materials. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

G. Record of Training to the Contracting Officer and Commissioning Authority. Provide a record of training. Record shall include list of attendees, student evaluation of training, evaluation of student comprehension at the end of training and recommendations for follow-on training.

3.3 SCHEDULE

A. Below is a schedule of demonstration and training requirements for installed system. Please note that this schedule should be considered as a guide; Contractor shall verify this schedule against the technical specification sections of this Project.

<table>
<thead>
<tr>
<th>SPECIFICATION SECTION NO.</th>
<th>TITLE</th>
<th>HOURS TRAINING</th>
<th>NOTES</th>
<th>VIDEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 36 20</td>
<td>Hangar Doors</td>
<td>4 Hours</td>
<td>Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain hangar doors.</td>
<td></td>
</tr>
<tr>
<td>08 71 00</td>
<td>Door Hardware</td>
<td>4 Hours</td>
<td>Engage a factory-authorized service representative to train the COR's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.</td>
<td></td>
</tr>
<tr>
<td>10 22 19</td>
<td>Demountable Partitions</td>
<td>2 Hours</td>
<td>Engage a factory-authorized service representative to train Government's mainte-</td>
<td></td>
</tr>
<tr>
<td>SPECIFICATION SECTION NO.</td>
<td>TITLE</td>
<td>HOURS TRAINING</td>
<td>NOTES</td>
<td>VIDEO</td>
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<td>-----------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>10 22 39</td>
<td>Folding Panel Partitions</td>
<td>2 Hours</td>
<td>Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain folding panel partitions.</td>
<td></td>
</tr>
<tr>
<td>11 24 29</td>
<td>Fall Protection Systems</td>
<td>4 Hours</td>
<td>Operator Training: Provide a minimum of one class (four hour minimum) of operator and maintenance training after system has been installed and proof tested. Training is to be for the users and maintainers of the system conducted at the installation site. The Contractor shall submit attendee list.</td>
<td></td>
</tr>
<tr>
<td>21 13 25</td>
<td>High Expansion Foam System</td>
<td>4 Hours</td>
<td>Contractor shall provide two sessions of 4 hours each of operation and maintenance training to the installation personnel on two different days to accommodate both shifts of the Installation Fire Emergency Services.</td>
<td></td>
</tr>
<tr>
<td>22 34 00</td>
<td>Fuel-Fired, Domestic-Water Heaters</td>
<td>2 Hours</td>
<td>Train Government's maintenance personnel to adjust, operate, and maintain gas-fired, tankless domestic-water heaters.</td>
<td></td>
</tr>
<tr>
<td>23 09 23</td>
<td>Instrumentation and Control for HVAC</td>
<td>20 Hours, 20 Hours</td>
<td>On-site training for 20 hours for Operator for two shifts of maintenance staff and 20 hours of Programming training for two shifts at a sanctioned training facility, owned and operated by the control system manufacturer.</td>
<td></td>
</tr>
<tr>
<td>23 11 23</td>
<td>Facility Natural Gas Piping</td>
<td>2 Hours</td>
<td>Engage a factory-authorized service representative to train Government’s maintenance personnel to adjust, operate, and maintain earthquake valves.</td>
<td></td>
</tr>
<tr>
<td>23 34 23</td>
<td>HVAC Power Ventilators</td>
<td>2 Hours</td>
<td>Provide on-site training for O&amp;M personnel; review O&amp;M Manuals, overview of system components, system operation under normal and abnormal conditions, emergency procedures, O&amp;M procedures.</td>
<td></td>
</tr>
<tr>
<td>SPECIFICATION SECTION NO.</td>
<td>TITLE</td>
<td>HOURS TRAINING</td>
<td>NOTES</td>
<td>VIDEO</td>
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<tr>
<td>---------------------------</td>
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</tr>
<tr>
<td>23 74 16.13</td>
<td>Packaged Large Capacity Rooftop AC units</td>
<td>4 Hours</td>
<td>Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain air-handling units.</td>
<td></td>
</tr>
<tr>
<td>23 81 26</td>
<td>Split-System Air Conditioners</td>
<td>24 Hours</td>
<td>Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain Split-System Air Conditioners Systems.</td>
<td></td>
</tr>
<tr>
<td>26 24 13</td>
<td>Switchboards</td>
<td>4 Hours</td>
<td>Train Government's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.</td>
<td></td>
</tr>
<tr>
<td>26 29 33</td>
<td>Controllers for Fire-Pump Drivers</td>
<td>2 Hours</td>
<td>Train Government's maintenance personnel to operate and maintain fire pump controllers.</td>
<td></td>
</tr>
<tr>
<td>26 32 26</td>
<td>Frequency Converter Units</td>
<td>24 Hours</td>
<td>Train Government's maintenance personnel during commissioning to operate and maintain frequency converter units. Training shall include a combination of over-the-shoulder and classroom training.</td>
<td></td>
</tr>
<tr>
<td>26 33 53</td>
<td>Static Uninterruptible Power Supply</td>
<td>4 Hours</td>
<td>Train Government's maintenance personnel to adjust, operate, and maintain the UPS.</td>
<td></td>
</tr>
<tr>
<td>28 31 11</td>
<td>Digital, Addressable Fire-Alarm &amp; Mass Notification System</td>
<td>4 Hours</td>
<td>Engage a factory-authorized service representative to train Government maintenance personnel to adjust, operate, and maintain the Fire Alarm system, appliances, and devices.</td>
<td></td>
</tr>
<tr>
<td>41 22 13.15</td>
<td>Bridge Cranes</td>
<td>2 Hours, 2 Hours</td>
<td>Minimum 2 hour operator training for operation and safety and 2 hour minimum maintenance and troubleshooting training.</td>
<td></td>
</tr>
<tr>
<td>41 22 23.19</td>
<td>Monorail Hoists</td>
<td>2 Hours</td>
<td>Operation, maintenance, and safety.</td>
<td></td>
</tr>
<tr>
<td>41 34 23.33</td>
<td>Spray Painting Booth and Sanding Room System</td>
<td>16 Hours</td>
<td>Operation, maintenance, and safety of Paint Booth and ventilation, Sanding Room and ventilation, Mixing Room and exhaust, and Air Shower.</td>
<td></td>
</tr>
</tbody>
</table>
END OF SECTION 01 79 00
SECTION 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for compliance with all USGBC LEED prerequisites and certain credits needed for Project to obtain a minimum of LEED Silver certification based on LEED 2009 for New Construction & Major Renovations. Each building will pursue its own certification as required by USGBC. This shall also include all required fees associated with obtaining the LEED Certification for each facility. LEED Silver equivalent is the goal requiring a minimum of 50 points to achieve. The contractor is responsible for tracking all LEED prerequisites and credits for which they are responsible as completely independent items in a manner that is acceptable to both the project’s LEED Administrator, and the USGBC, as applicable to each building. Each facility’s LEED Prerequisites and Credits shall be documented as entirely separate projects as required by USGBC.

1. LEED prerequisites and some credits needed to obtain LEED certification depend on material 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. LEED prerequisites and some 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.

3. A copy of each building’s LEED Project checklist is attached at the end of this Section for information only. See Section “Sustainable Design Requirements “01 81 13, Attachment A and B. The LEED Project checklist is for information purposes only; construction credits indicated are guidelines, and may change during the course of the project pending additional analysis and review. The contractor shall work with the project’s LEED Admin to ensure proper documentation of individual building credits and associated with each project’s approach for certifying independently under v3.

4. A copy of the Materials Credit Documentation Sheet for credits MR 4, MR 5, MR 7, and EQ 4 is attached at the end of this Section for use with any product submittal concerning the above mentioned credits.

5. Specific requirements for LEED are also included in other Sections.

B. Related Sections:

1. Divisions 01 through 33 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

1.2 DEFINITIONS

A. 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.

B. LEED: Leadership in Energy & Environmental Design.

C. Regionally Extracted and Manufactured Materials: Regionally manufactured materials made from raw materials that are extracted, harvested, or recovered within a radius of 500 miles from Project site.

D. Recycled Content Value: 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. "Post-consumer" material is defined as 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. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is 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.

E. Recycled Content: The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).

1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.

2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect and the USGBC/GBCI regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor’s procedures until the USGBC/GBCI has made its determination on the project’s LEED certification application. The final determination will occur after construction is complete; Contractor shall remain available after this point to respond to clarification requests from USGBC during final review. Document responses as informational submittals.

1.4 ACTION SUBMITTALS

A. General: Submit additional LEED submittals required by other Specification Sections.

B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
C. Complete and submit in notebook and electronic, editable form (interactive PDF LEED templates) all construction credit templates and supporting documentation and verify in writing that documentation has met LEED 2009 requirements for each facility. Contractor is also responsible for completing LEED templates on the designated LEED project websites, and uploading all necessary supporting documentation. Submit within 60 days following completion of construction.

D. LEED Template and Supporting Documentation Submittals:

1. Prerequisite SS 1: Construction Activity Pollution Prevention - Erosion and Sedimentation Control (ESC) Plan. Prevent the loss of soil during construction, the sedimentation of local waters, and the polluting of air.

2. Credit MR 2.1 and Credit MR 2.2: Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3. Credit MR 4.1 and Credit MR 4.2: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

4. Credit MR 5.1 and Credit MR 5.2: Product data indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each regionally manufactured material. Include statement indicating cost for each regionally manufactured material and for each regionally extracted and manufactured material.
   a. Include statement indicating distance from manufacturer to Project for each regionally manufactured material.
   b. Include statement indicating location of and distance from Project to point of extraction, harvest, or recovery for each raw material used in regionally extracted and manufactured materials.

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. Receipts showing purchase must be itemized as required by USGBC Memorandum dated April 7, 2008.

6. Credit EQ 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: Twenty photographs at a minimum 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. Incremental photographs showing construction progress in several example spaces are highly recommended.

7. Credit EQ 3.2:
   If using building air flush-out procedures:
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.

If using Contractor-engaged, indoor-air-quality testing:

a. Report 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 EQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.

9. Credit EQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.

10. Credit EQ 4.3: Product data for carpet systems (carpet, cushion, and adhesive) and flooring systems (hard surface flooring product, tile setting adhesive, finishes, and grout) used in the project indicating the VOC content of each product used. Indicate compliance with the Carpet and Rug Institute’s Green Label Plus program, and indicate VOC content in g/L, meeting the requirements of Credit EQ 4.1, limit of 50 g/L.

11. Credit EQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde.

12. Any associated Innovation in Design credits if they are earned by exemplary performance from any of the above listed items.

1.5 INFORMATIONAL SUBMITTALS

A. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project, excluding labor, overhead, and profit. Include breakout of cost 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

B. LEED Action Plans: Provide preliminary submittals within 30 days of date established for the Notice to Proceed indicating how the following requirements will be met for Contracting Officer review and approval. Each facility shall have its own LEED Action Plan.

1. Prerequisite SS 1: Erosion and Sedimentation Control (ESC) Plan. Prevent the loss of soil during construction, the sedimentation of local waters, and the polluting of air.
2. Credit MR 2.1 and Credit MR 2.2: Waste management plan complying with Section 017419, "Construction Waste Management and Disposal."
3. Credit MR 4.1 and Credit MR 4.2: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.

4. Credit MR 5.1 and Credit MR 5.2: List of proposed regionally manufactured materials and regionally extracted and manufactured materials.
   a. Identify each regionally manufactured material, including its source and cost.
   b. Identify each regionally extracted and manufactured material, including its source and cost.

5. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.

6. Credit EQ 3.1 and EQ 3.2: Construction indoor-air-quality management plan, during construction and before occupancy.

7. Credit EQ 4.1, 4.2, 4.3, and 4.4: List of proposed low emitting materials. Identify each material and its VOC content including, but not limited to:
   a. Adhesives and Sealants
   b. Paints and Coatings
   c. Carpet and Flooring Systems
   d. Composite Wood and Agrifiber Products

C. LEED Progress Reports: Each facility shall have its own LEED Progress Reports. Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:

1. Prerequisite SS 1: Erosion and Sedimentation Control (ESC) Plan. Prevent the loss of soil during construction, the sedimentation of local waters, and the polluting of air.
3. Credit MR 4.1 and Credit MR 4.2: Recycled content.
4. Credit MR 5.1 and Credit MR 5.2: Regionally manufactured materials and regionally extracted and manufactured materials.
5. Credit MR 7: Certified wood products.
6. Credit EQ 3.1 and Credit EQ 3.2: Indoor air quality measures.
7. Credits EQ 4.1, 4.2, 4.3, and 4.4: Low-emitting materials.

1.6 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. Contractor’s LEED AP is responsible for completing LEED documentation for Construction Credits to the government for each facility. 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 LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.2 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4.1 and Credit MR 4.2: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of cost of materials used for Project, with a project goal of 30 percent.

1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.

2. Do not include mechanical and electrical components, or specialty components such as elevators and equipment in the calculation.

2.3 REGIONAL MATERIALS

A. Credit MR 5.1 and Credit MR 5.2: Provide a minimum of 20 percent of building materials (by cost) that are regional materials, with a project goal of 30 percent.

B. Credit MR 5.2: Provide a minimum of 20 percent of materials (by cost) that are regionally extracted and manufactured materials, with a project goal of 30 percent.

2.4 CERTIFIED WOOD

A. Credit MR 7: Provide a minimum of 50 percent (by cost), striving for 95 percent of wood-based materials that are 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 EQ 4.1: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. 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, Teflon, ultra-high molecular weight polyethylene, 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: 350 g/L.
23. ABS Welding Compounds: 400 g/L.
24. CPVC Welding Compounds: 490 g/L.
25. PVC Welding Compounds: 510 g/L.
26. Adhesive Primer for Plastic: 650 g/L.
27. Sheet Applied Rubber Lining Adhesive: 850 g/L.
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 EQ 4.2: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:

1. Flat Paints, Coatings, and Primers: VOC not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC not more than 150 g/L.
3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
6. Floor Coatings: VOC not more than 100 g/L.
7. Shellacs, Clear: VOC not more than 730 g/L.
8. Shellacs, Pigmented: VOC not more than 550 g/L.
9. Stains: VOC not more than 250 g/L.
10. Flat Interior Topcoat Paints: VOC not more than 50 g/L.
11. Nonflat Interior Topcoat Paints: VOC not more than 150 g/L.
12. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
13. Clear Wood Finishes, Varnishes and Sanding Sealers: VOC not more than 350 g/L.
14. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
15. Floor Coatings: VOC not more than 100 g/L.
16. Shellacs, Clear: VOC not more than 730 g/L.
17. Shellacs, Pigmented: VOC not more than 550 g/L.
18. Stains: VOC not more than 250 g/L.
19. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
20. Dry-Fog Coatings: VOC not more than 400 g/L.
22. Pretreatment Wash Primers: VOC not more than 420 g/L.
23. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
24. Restricted Components: Paints and coatings shall not contain any of the following:
   a. Acrolein.
   b. Acrylonitrile.
   c. Antimony.
   d. Benzene.
   e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

C. Credit EQ 4.3: For carpet systems installed in the project, provide a listing of each carpet product installed in the building interior. Confirm that the product complies with the CRI Green Label Plus testing program. Also provide a listing of each carpet cushion product installed in the building interior. Confirm that the product complies with the CRI (Carpet and Rug Institute) Green Label testing program.

D. Credit EQ 4.4: Do not use composite wood or agrifiber products or adhesives that contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.1 CONSTRUCTION ACTIVITY POLLUTION PREVENTION

A. Prerequisite SS 1: Erosion and Sedimentation Control (ESC) Plan. Prevent the loss of soil during construction, the sedimentation of local waters, and the polluting of air.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Credit MR 2.1 and Credit MR 2.2: Comply with Division 01 Section "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Credit EQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
1. If Government authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "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 all air filters immediately prior to occupancy with MERV 13 rated filters.

B. Credit EQ 3.2: Comply with one of the following requirements:

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.

2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. 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. of outside air or the design minimum outside air rate determined in EQ Prerequisite 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 14000 cu. ft./sq. ft. of outside air has been delivered to the space.

3. Calculations must be performed by the Contractor to determine length of flush-out needed to meet option chosen in order to incorporate the necessary time into the overall project schedule.

4. Air-Quality Testing:

   a. 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 the USGBC's "LEED-NC: Reference Guide."

   b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:

   1) Formaldehyde: 50 ppb.
   2) Particulates (PM10): 50 micrograms/cu. m.
   3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
   4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
   5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.

   c. 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.

   d. Air-sample testing shall be conducted as follows:
1) 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 air flow rate for the occupied mode throughout the duration of the air testing.

2) 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.

3) Number of sampling locations will vary 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. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.

4) Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.
LEED MATERIALS DOCUMENTATION SHEET

☐ NO LEED INFORMATION REQUIRED FOR SUBMITTAL

<table>
<thead>
<tr>
<th>CSI #:</th>
<th></th>
</tr>
</thead>
</table>

**MATERIAL OR PRODUCT:**

**MATERIAL COST (LESS LABOR OR EQUIPMENT):**

<table>
<thead>
<tr>
<th>Contractor / Installer</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Name:</td>
</tr>
<tr>
<td>Address:</td>
<td>Address:</td>
</tr>
<tr>
<td>E-mail:</td>
<td>E-mail:</td>
</tr>
<tr>
<td>Contact:</td>
<td></td>
</tr>
</tbody>
</table>

Signed by: ___________________________ Date: ___________________________

Company: ________________________________________________

*Instruction to Contractor / Installer:* Complete the following information in all appropriate categories. Use one documentation form for each product and material (e.g. tile and grout each get their own sheet). This sheet is in addition to, not a replacement for, other required submittal information. Please attach any and all other additional information to this sheet (e.g. cut sheets, MSDS sheets, letters or product information from manufacturers, etc.).

### LEED MR Credit 4 - Recycled Content

*Does the material / product contain post-consumer or pre-consumer recycled content?*  
- Yes ☐  
- No ☐

*Percentage of post-consumer content:*

<table>
<thead>
<tr>
<th>Assembly Components</th>
<th>Weight</th>
<th>% Post-consumer</th>
<th>% Pre-consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

*Percentage of pre-consumer content:*

<table>
<thead>
<tr>
<th>Assembly Components</th>
<th>Weight</th>
<th>% Post-consumer</th>
<th>% Pre-consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

*Note:* Assembly Recycled Content % = \[\text{material weight (lbs) x recycled content / total weight (lbs)}\] x 100

### LEED MR Credit 5 - Regional Materials: extracted, processed, and manufactured

*Was the material / product manufactured regionally (within 500 miles of project site)?*  
- Yes ☐  
- No ☐

*Location of Manufacturer / Fabricator (City / State or Province):*

*Distance of Manufacturer / Fabricator to Project Site in miles:*

*Does the material / product contain regionally extracted, harvested, or recovered materials? (Regionally is defined as within 500 miles of the project)*  
- Yes ☐  
- No ☐

<table>
<thead>
<tr>
<th>Raw Materials</th>
<th>City / State / Province</th>
<th>Miles to Project Site</th>
<th>% of Material $</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

*Note:* Place each product/material in its own row in the table. If only part of the assembly contains recycled content, refer to the LEED Reference Guide for instructions on how to document.
### LEED MR Credit 7 – FSC Certified Wood Materials

**Does the material / product contain FSC certified wood?**

<table>
<thead>
<tr>
<th>Component</th>
<th>Chain of Custody Certificate #</th>
<th>% of Material</th>
</tr>
</thead>
</table>

Provide a copy of the certificate, and provide itemized receipts validating cost of materials. If only part of the assembly contains recycled content, refer to the LEED Reference Guide for instructions on how to document.

### LEED EQ Credit 4.1 - Low-Emitting Materials: Adhesives & Sealants

**Does the material / product comply with LEED VOC content requirements?**

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer</th>
<th>VOC g/L</th>
<th>LEED VOC limit g/L</th>
</tr>
</thead>
</table>

### LEED EQ Credit 4.2 - Low-Emitting Materials: Paints & Coatings

**Does the material / product comply with LEED VOC content requirements?**

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer</th>
<th>VOC g/L</th>
<th>LEED VOC limit g/L</th>
</tr>
</thead>
</table>

### LEED EQ Credit 4.3 - Low-Emitting Materials: Flooring Systems

**Does the material / product comply with corresponding LEED requirements?**

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer</th>
</tr>
</thead>
</table>

Compliant with Green Label Plus, Green Label, Floorscore, SMAQMD 1113, or SCAQMD 1168.

### LEED EQ Credit 4.4 - Low-Emitting Materials: Composite Wood & Agrifiber Products

**Does the material / product comply with LEED no added UF requirements?**

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer</th>
</tr>
</thead>
</table>

Contains Urea-formaldehyde (UF)? (Yes / No)

---

Additional comments:

END OF SECTION 01 81 13
### LEED 2009 for New Construction and Major Renovations

**Project Checklist**

#### Sustainable Sites Possible Points: 26

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction Activity Pollution Prevention</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>Site Selection</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>Development Density and Community Connectivity</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>Brownfield Redevelopment</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>Alternative Transportation—Public Transportation Access</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>Alternative Transportation—Bicycle Storage and Changing Rooms</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>Site Development—Protect or Restore Habitat</td>
<td>Y</td>
</tr>
<tr>
<td>9</td>
<td>Site Development—Maximize Open Space</td>
<td>Y</td>
</tr>
<tr>
<td>10</td>
<td>Stormwater Design—Quantity Control</td>
<td>Y</td>
</tr>
<tr>
<td>11</td>
<td>Stormwater Design—Quality Control</td>
<td>Y</td>
</tr>
<tr>
<td>12</td>
<td>Heat Island Effect—Non-roof</td>
<td>Y</td>
</tr>
<tr>
<td>13</td>
<td>Heat Island Effect—Roof</td>
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<tr>
<td>14</td>
<td>Light Pollution Reduction</td>
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#### Energy and Atmosphere Possible Points: 35

<table>
<thead>
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<th>Credit</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Fundamental Commissioning of Building Energy Systems</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>Minimum Energy Performance</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>Fundamental Refrigerant Management</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>Optimize Energy Performance</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>On-Site Renewable Energy</td>
<td>Y</td>
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<tr>
<td>6</td>
<td>Enhanced Commissioning</td>
<td>Y</td>
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<tr>
<td>7</td>
<td>Enhanced Refrigerant Management</td>
<td>Y</td>
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<tr>
<td>8</td>
<td>Measurement and Verification</td>
<td>Y</td>
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<tr>
<td>9</td>
<td>Green Power</td>
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#### Water Efficiency Possible Points: 10

<table>
<thead>
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<th>Credit</th>
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<tbody>
<tr>
<td>1</td>
<td>Water Use Reduction—20% Reduction</td>
<td>Y</td>
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<tr>
<td>2</td>
<td>Water Efficient Landscaping</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>Innovative Wastewater Technologies</td>
<td>Y</td>
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<tr>
<td>4</td>
<td>Water Use Reduction</td>
<td>Y</td>
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#### Materials and Resources Possible Points: 14

<table>
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<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Storage and Collection of Recyclables</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>Building Reuse—Maintain Existing Walls, Floors, and Roof</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>Building Reuse—Maintain 50% of Interior Non-Structural Elements</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>Construction Waste Management</td>
<td>Y</td>
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<tr>
<td>5</td>
<td>Materials Reuse</td>
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#### Indoor Environmental Quality Possible Points: 15

<table>
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<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
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<tbody>
<tr>
<td>1</td>
<td>Minimum Indoor Air Quality Performance</td>
<td>Y</td>
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<tr>
<td>2</td>
<td>Environmental Tobacco Smoke (ETS) Control</td>
<td>Y</td>
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<tr>
<td>3</td>
<td>Outdoor Air Delivery Monitoring</td>
<td>Y</td>
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<tr>
<td>4</td>
<td>Increased Ventilation</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>Construction IAQ Management Plan—During Construction</td>
<td>Y</td>
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<tr>
<td>6</td>
<td>Construction IAQ Management Plan—Before Occupancy</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>Low-Emitting Materials—Adhesives and Sealants</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>Low-Emitting Materials—Paints and Coatings</td>
<td>Y</td>
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<td>9</td>
<td>Low-Emitting Materials—Flooring Systems</td>
<td>Y</td>
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<tr>
<td>10</td>
<td>Low-Emitting Materials—Composite Wood and Agrifiber Products</td>
<td>Y</td>
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<tr>
<td>11</td>
<td>Indoor Chemical and Pollutant Source Control</td>
<td>Y</td>
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<td>12</td>
<td>Controllability of Systems—Lighting</td>
<td>Y</td>
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<tr>
<td>13</td>
<td>Controllability of Systems—Thermal Comfort</td>
<td>Y</td>
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<tr>
<td>14</td>
<td>Thermal Comfort—Design</td>
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<td>15</td>
<td>Thermal Comfort—Verification</td>
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<tr>
<td>16</td>
<td>Daylight and Views—Daylight</td>
<td>Y</td>
</tr>
<tr>
<td>17</td>
<td>Daylight and Views—Views</td>
<td>Y</td>
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</table>

#### Innovation and Design Process Possible Points: 6

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Innovation in Design: Bird Collision Deterrence</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>Innovation in Design: Sustainable Purchasing - Low Mercury Lamps</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>Innovation in Design: Green Education</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>Innovation in Design: Exemplary Performance for MR Cr 4</td>
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</table>

#### Regional Priority Credits Possible Points: 4

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regional Priority: SS Cr 6.1 - Stormwater Design</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>Regional Priority: WE Cr 3 - Reduced Water Use</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>Regional Priority: EA Cr 1 - 28% Reduction</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>Regional Priority: EQ Cr 7.1 - Thermal Comfort, Design</td>
<td>Y</td>
</tr>
</tbody>
</table>

#### Total Possible Points: 110

Certified 40 to 49 points  Silver 50 to 59 points  Gold 60 to 79 points  Platinum 80 to 110
### Sustainable Sites

<table>
<thead>
<tr>
<th>Possible Points: 26</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Credit 1</strong> Site Selection 1</td>
</tr>
<tr>
<td><strong>Credit 2</strong> Development Density and Community Connectivity 5</td>
</tr>
<tr>
<td><strong>Credit 3</strong> Brownfield Redevelopment 1</td>
</tr>
<tr>
<td><strong>Credit 4.1</strong> Alternative Transportation—Public Transportation Access 6</td>
</tr>
<tr>
<td><strong>Credit 4.2</strong> Alternative Transportation—Bicycle Storage and Changing Rooms 1</td>
</tr>
<tr>
<td><strong>Credit 4.3</strong> Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles 3</td>
</tr>
<tr>
<td><strong>Credit 4.4</strong> Alternative Transportation—Parking Capacity 2</td>
</tr>
<tr>
<td><strong>Y</strong> Site Development—Protect or Restore Habitat 1</td>
</tr>
<tr>
<td><strong>Credit 5.1</strong> Site Development—Maximize Open Space 1</td>
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<tr>
<td><strong>Credit 6.1</strong> Stormwater Design—Quantity Control 1</td>
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<td><strong>Credit 6.2</strong> Stormwater Design—Quality Control 1</td>
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<tr>
<td><strong>Credit 7.1</strong> Heat Island Effect—Non-roof 1</td>
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<td><strong>Credit 7.2</strong> Heat Island Effect—Roof 1</td>
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<td><strong>Credit 8</strong> Light Pollution Reduction 1</td>
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### Water Efficiency

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<tr>
<td><strong>Credit 1</strong> Water Use Reduction—20% Reduction 4 to 2</td>
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<td><strong>Credit 2</strong> Innovative Wastewater Technologies 2</td>
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<tr>
<td><strong>Credit 3</strong> Water Use Reduction 4</td>
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### Energy and Atmosphere

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<td><strong>Credit 1</strong> Fundamental Commissioning of Building Energy Systems 12</td>
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<td><strong>Credit 2</strong> Minimum Energy Performance 7</td>
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<td><strong>Credit 3</strong> Enhanced Commissioning 2</td>
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<tr>
<td><strong>Credit 4</strong> Enhanced Refrigerant Management 2</td>
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<tr>
<td><strong>Credit 5</strong> Measurement and Verification 3</td>
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<td><strong>Credit 6</strong> Green Power 2</td>
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### Materials and Resources

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<tr>
<td><strong>Credit 1.1</strong> Building Reuse—Maintain Existing Walls, Floors, and Roof 3</td>
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<tr>
<td><strong>Credit 1.2</strong> Building Reuse—Maintain 50% of Interior Non-Structural Elements 1</td>
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<tr>
<td><strong>Credit 2</strong> Construction Waste Management 2</td>
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<td><strong>Credit 3</strong> Materials Reuse 2</td>
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### Indoor Environmental Quality

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<tr>
<td><strong>Credit 1</strong> Minimum Indoor Air Quality Performance 11</td>
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<td><strong>Credit 2</strong> Environmental Tobacco Smoke (ETS) Control 4</td>
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<td><strong>Credit 3</strong> Indoor Environmental Quality 1</td>
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<td><strong>Credit 4</strong> Outdoor Air Delivery Monitoring 1</td>
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<td><strong>Credit 5</strong> Increased Ventilation 1</td>
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<td><strong>Credit 6</strong> Construction IAQ Management Plan—During Construction 1</td>
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<td><strong>Credit 7</strong> Construction IAQ Management Plan—Before Occupancy 1</td>
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<td><strong>Credit 8</strong> Construction IAQ Management Plan—Before Occupancy 1</td>
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<td><strong>Credit 9</strong> Low-Emitting Materials—Adhesives and Sealants 1</td>
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<td><strong>Credit 10</strong> Low-Emitting Materials—Paints and Coatings 1</td>
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<td><strong>Credit 11</strong> Low-Emitting Materials—Flooring Systems 1</td>
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<td><strong>Credit 12</strong> Certified Wood 1</td>
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<td><strong>Credit 13</strong> Low-Emitting Materials—Composite Wood and Agrifiber Products 1</td>
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<tr>
<td><strong>Credit 14</strong> Indoor Chemical and Pollutant Source Control 1</td>
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<td><strong>Credit 15</strong> Controllability of Systems—Lighting 1</td>
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<td><strong>Credit 16</strong> Controllability of Systems—Thermal Comfort 1</td>
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<tr>
<td><strong>Credit 17</strong> Thermal Comfort—Design 1</td>
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<td><strong>Credit 18</strong> Thermal Comfort—Verification 1</td>
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<td><strong>Credit 19</strong> Daylight and Views—Daylight 1</td>
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<td><strong>Credit 20</strong> Daylight and Views—Views 1</td>
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### Innovation and Design Process

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<tr>
<td><strong>Credit 1.1</strong> Innovation in Design: Bird Collision Deterrence 3</td>
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<tr>
<td><strong>Credit 1.2</strong> Innovation in Design: Sustainable Purchasing - Low Mercury Lamps 1</td>
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<td><strong>Credit 1.3</strong> Innovation in Design: TBD 1</td>
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<td><strong>Credit 1.4</strong> Innovation in Design: Green Education 1</td>
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<td><strong>Credit 1.5</strong> Innovation in Design: Exemplary Performance for MR Cr 4 1</td>
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<tr>
<td><strong>Credit 2</strong> LEED Accredited Professional 1</td>
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### Regional Priority Credits

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<tr>
<td><strong>Credit 1.1</strong> Regional Priority: SS Cr 6.1 - Stormwater Design - Quantity Control 1</td>
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<tr>
<td><strong>Credit 1.2</strong> Regional Priority: WE Cr 3 - Reduced Water Use - 40% reduction 1</td>
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<td><strong>Credit 1.3</strong> Regional Priority: EA Cr 1 - 28% Reduction 1</td>
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<td><strong>Credit 1.4</strong> Regional Priority: EQ Cr 7.1 - Thermal Comfort, Design 1</td>
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### Total Possible Points: 110

Certified 40 to 49 points  Silver 50 to 59 points  Gold 60 to 79 points  Platinum 80 to 110
SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative activities for Commissioning. Commissioning is a team-directed, systematic process of ensuring that all building systems perform individually and interactively according to the design intent and the Government’s operational needs and that these systems can be maintained to perform as intended throughout the building life cycle. The Commissioning Process facilitates and coordinates the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. North Carolina (NC) Air National Guard C-17 Corrosion Control / Fuel Cell Hangar and Flight Simulator Training Facilities shall meet LEED criteria for sustainable design. The Contractor and Commissioning Agent shall comply with and provide documentation for LEED prerequisite credit requirements for Fundamental Commissioning. The Contractor and the Commissioning Agent shall coordinate with the Government and the rest of project team as required to achieve the required LEED Certifications. Refer to Section 01 81 13 “Sustainable Design Requirements” for additional information and requirements.

B. The Government shall hire an Independent Commissioning Authority (CxA) to direct and facilitate the Commissioning Process in accordance with this Section and the Commissioning Plan provided with the solicitation. The GC shall cooperate fully with the CxA and the Contracting Officer (CO) to support the Commissioning Process.

C. Systems to be commissioned under this project include, but are not limited to, the following:

1. HVAC Systems.
2. HVAC Control System
3. Paint Booth/Sanding Room System
4. Plumbing Systems
5. Electrical System
   a. Lighting and Daylighting Controls
   b. Switchboards
   c. Panelboards
6. Fire Alarm System/Mass Notification System
7. Fire Suppression System
   a. Fire Pump
   b. High Expansion Foam system
   c. Automatic wet-pipe sprinkler system
   d. Pre-action sprinkler system

D. Commissioning Plan. The Commissioning Plan for this project is included in the Construction Contract solicitation. The requirements in the plan are part of the Construction Contract. The
plan describes the commissioning process, specific systems and equipment to be commissioned and roles and responsibilities. The plan includes sample checklists that the contractor in coordination with the Independent Commissioning Agent shall complete during equipment installation and start-up. The plan and checklists will be updated by the CxA during construction as specific equipment information is obtained and construction progresses. The Commissioning Plan includes:

1. Introduction.
2. Participants in the Commissioning Process.
3. Roles and Responsibilities.
5. List of Systems to be Commissioned and Preliminary Equipment List.

E. Commissioning and facility turnover requirement is in this Section, Section 01 78 23, "Operation and Maintenance Data," and Section 01 79 00, "Demonstration and Training" of the Specifications and other Sections in Division 2 through 33 shall be coordinated with the CxA.

F. Commissioning shall achieve the following objectives:

1. Verify that applicable equipment and systems are installed according to the contract requirements, manufacturer’s recommendations and to accepted industry standards and ensure adequate operational checkout by installing contractors.
2. Verify and document proper operational performance of equipment and systems.
3. Verify that O&M documentation is complete.
4. Verify that the Facility's operations and maintenance personnel have been trained.

G. Commissioning Process. The Commissioning Process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product. Commissioning also should not add to the overall work effort. Commissioning puts a focus on standard installation and startup procedures, documentation, and early problem resolution to permit a smooth turnover and acceptance at project completion.

1.2 SUBMITTALS

A. Name and qualifications of the Commissioning Authority. The proposed CxA shall have a minimum of ten years experience and shall have successfully commissioned a facility similar to the NC Air National Guard C-17 Corrosion Control / Fuel Cell Hangar and Flight Simulator Training Facilities within the past three years.

B. Name and qualifications of Contractor's Commissioning Representative(s).

C. Submit proposed schedule which shall include major equipment to be commissioned and anticipated dates for testing, startup and training of this equipment.

D. The Contractor shall submit completed checklists and deficiency/nonconformance reports to the Contracting Officer and CxA immediately upon completion of each check or test.
1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the GPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. CxA: Commissioning Authority.

C. GPR: Government's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

D. FPT: Functional Performance Test.

E. IST: Integrated Systems Test.

F. PFVC: Pre-functional Verification Checklist.

G. TAB: Testing and Balancing.

H. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COORDINATION

A. Commissioning Team. The members of the Commissioning Team shall include the following:

1. General Contractor (GC).
2. Commissioning Authority (CxA).
3. Contracting Officer (CO).
4. Contracting Officer's Representative (COR).

B. The CxA directs and coordinates the Commissioning activities. The CxA reports to the Contracting Officer and coordinates Commissioning activities with the Contracting Officer. All members of the Commissioning Team shall work together to fulfill their contractual responsibilities to meet the objectives of the Contract Documents.

C. Scheduling. The CxA will work with the Contracting Officer and the GC to establish Commissioning activities within the Construction Schedule. The CxA will provide sufficient notice to the Contracting Officer and the GC for scheduling Commissioning activities. The GC shall integrate all Commissioning activities into the master schedule. All parties shall address scheduling problems and make necessary notifications in a timely manner in order to expedite the Commissioning Process.
1.5 COMMISSIONING PROCESS

A. Commissioning Plan. The Government has developed a Commissioning Plan based on the design documents to guide the Commissioning Process.

B. The Commissioning Plan shall be updated by the CxA throughout construction as more information on equipment is obtained from the GC and the work progresses.

1. Commissioning checklists and the equipment list shall be updated as specific manufacturers and models of equipment are submitted by the GC and approved for installation.

2. Specific checks and tests shall be performed and documented on checklists for the Prefunctional Verification Checks, Functional Performance Tests, controls tests and Integrated Systems Tests. The GC and installing subcontractors shall document that PFVC and FPT checks are complete by initialing the specific checks on each individual PFVC and FPT. The CxA shall check for compliance. The CxA shall oversee the controls testing and integrated systems testing. The GC shall sign off on these tests.

3. Sample pre-functional checklists are provided in the Commissioning Plan. The samples are not complete at this time, nor are they all-inclusive. However, they illustrate the level of detail that is required. For the systems being commissioned, the contractor should anticipate completing checklists plus systems tests and integrated systems tests.

4. The CxA shall update the Commissioning Plan to incorporate changes in key personnel, construction modifications, schedule changes and other events that may affect the Commissioning Process.

C. Commissioning Process. The following are anticipated Commissioning tasks and the approximate order in which they will occur:

1. A Commissioning Kick-Off Meeting shall be conducted by the CxA to review the Commissioning Process with the Commissioning Team Members. This shall be done as soon as practicable after GC's receipt of written Notice to Proceed from the Contracting Officer.

2. Meetings shall be required throughout construction, scheduled by the CxA with necessary parties attending, to plan scope, coordinate, schedule future activities, and resolve problems.

3. Equipment documentation including detailed manufacturer’s installation and start up procedures shall be submitted by the GC during equipment submittal approval.

4. The CxA shall work with the Contracting Officer and GC in developing startup plans and startup documentation formats, including providing prefunctional checklists to be completed, during the startup process.

5. In general, the checkout and performance verification will proceed from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before start-up and functional testing.
6. The Contracting Officer and GC shall document equipment installations and start-ups on the PFVC’s and FPT’s according to the plan. The CxA shall witness installation and start-up of selected and critical equipment.

7. The CxA shall develop required specific equipment and system functional performance test procedures.

8. The procedures shall be executed and documented by the GC with the CxA’s participation.

9. Items of non-compliance shall be noted and documented. Corrective action by the appropriate party shall be noted and documented after completion of the corrective action.

10. The CxA shall confirm that the O&M documentation is in accordance with the Specifications and has been turned over to the Contracting Officer.

11. The CxA shall review training plans and verify training performed by the Contractor.

12. Any deferred seasonal functional performance testing shall be performed by the GC and CxA when weather and load conditions are appropriate for testing. These tests may occur during the post occupancy phase.

D. Commissioning Tests and Checklists. Commissioning checklists will be developed for each individual equipment item to be commissioned. The CxA will develop checklists for three levels of testing. In addition, the CxA will develop a procedure to test controls and sequences of operation:

1. Pre-Functional Verification Checks (PFVC). Pre-functional verification checks cover the activities that must be performed for the proper storage, handling and installation of building components and equipment. These are the activities that are performed and checked prior to start-up.

2. Functional Performance Tests (FPT). Functional performance tests cover the activities associated with starting and running dynamic equipment and systems to insure set-up, alignment, and operation are in accordance with the design. For non-dynamic components, functional checks ensure proper function.

3. Integrated System Tests (IST). Integrated testing involves ensuring proper operation where two or more separate systems interact with each other.

E. The CxA shall develop the checklists and tests with support and input from the Commissioning Team. The GC shall provide manufacturer’s O&M data, installation and start-up directions for incorporation into the checklists. The GC shall obtain these documents from the equipment manufacturer’s operations and maintenance manuals. See the Section 01 78 23, "Operation and Maintenance Data" for requirements. Checklists may incorporate manufacturer’s instructions directly or by reference.

F. The GC shall initiate, execute and sign-off on the checklists. Non-compliance issues shall be noted on a separate deficiency/non-conformance report to be developed and provided by the CxA.

G. Various Divisions and Sections of the Specification include Commissioning requirements. These requirements will be included in the Commissioning tests and checklists, but shall not be interpreted to be the only Commissioning requirements. The Commissioning Plan, tests and checklists shall take precedence.
H. The GC shall turn in completed checklists and deficiency/nonconformance reports to the Contracting Officer and CxA immediately upon completion of each check or test.

1.6 ROLES AND RESPONSIBILITIES

A. The roles and responsibilities of the Commissioning Team members are described in the Commissioning Plan.

B. The Government’s responsibilities from the Commissioning Plan include:

1. Provide the GPR documentation to the CxA and each Contractor for information and use.
2. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
3. Provide the BoD documentation, prepared and approved by Government, to the CxA and each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

C. General Contractor responsibilities from the Commissioning Plan include:

1. Cooperate with the CxA, and other Commissioning Team members, to facilitate the successful completion of the Commissioning Process.
2. Assign a representative to the Commissioning Team; submit that person's name to the Contracting Officer and CxA within one month after receipt of the written Notice to Proceed from the Contracting Officer. This is typically assigned as a collateral duty to the GC’s Project Superintendent or Quality Control Manager. The GC representative shall have the authority to make decisions on behalf of the Contractor as they relate to the organization and scheduling of Commissioning events. The representative shall ensure communications between Contractor and suppliers and all other Commissioning Team members, and shall foster necessary cooperative action.
3. Attend Commissioning Meetings and ensure action items arising from these meetings are performed as required to allow the Commissioning Process to proceed on schedule.
4. Ensure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, and water treatment as applicable.
5. Ensure participation of major equipment manufacturers in appropriate start-up, testing and training activities.
6. Notify the CxA a minimum of two weeks in advance of scheduled equipment and system start-ups and FPT’s so that the CxA may witness.
7. Inspect, check and confirm the correct and complete installation of all equipment and systems included in the Commissioning Plan prior to start-up. Document the results of inspections and checks on the checklists and sign them. If deficient or incomplete work is discovered, ensure corrective action is taken and re-check until the results are satisfactory and the system is ready for safe start-up.
8. Provide all tools/equipment and personnel required to perform all checks and tests.
9. Provide Operations and Maintenance Documentation in accordance with the Construction Specifications. This includes completing the equipment inventory.
10. Provide demonstration and training in accordance with the Construction Specifications.
11. Provide personnel to assist the CxA during system verification and FPTs. Operate equipment and systems for FPTs in accordance with the Commissioning plan and as directed by the CxA. If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the CxA will stop the FPTs. Those responsible for deficient or incomplete work will be responsible to ensure corrections necessary for full and complete system operation as specified are completed. Once the deficiencies are corrected the GC shall support the continuation of the test or retesting process as directed by the CxA.

12. Provide operation and maintenance documentation in accordance with Section 01 78 23, "Operation and Maintenance Data."

D. Commissioning Authority Responsibilities from the Commissioning Plan include:

1. Update and execute the commissioning plan, which describes in general the extent of the commissioning process to accomplish the design intent and coordinate with the construction schedule.

2. Organize and lead the commissioning team and coordinate commissioning activities in a logical, sequential and efficient manner.

3. Plan commissioning related meetings. Set and execute agenda items and document meeting notes.

4. Update and develop Pre-Functional Verification Checklists (PFVCs). Develop Functional Performance Tests (FPTs) and the Integrated Systems Test (ISTs) based on the Contract Documents, manufacturers’ O&M information, and accessibility requirements for O&M. Bring to the attention of the Design Manager (DM), CM, GC and DCANG identified deficiencies and coordination problems with systems/equipment to be commissioned.

5. Monitor/review PFVCs, and ensure the results are documented as the checklists are completed.

6. Track testing non-conformance(s). Coordinate re-testing as necessary, until satisfactory performance is achieved.

7. Compile and maintain organized and complete commissioning records.

8. Review draft O&M submittal installation and start-up instructions and incorporate those instructions into PFVC and FPT procedures. Coordinate with the CM and GC for integrated systems tests.

9. Establish test plans and schedules with the commissioning team.

10. Review and approve training plans. Oversee training.

11. Witness all critical tests, ISTs and a sample of non-critical tests of all systems and equipment to be commissioned.

12. Review all PFVC, FPT, and IST results.

13. Revise the Commissioning Plan as required during construction, based upon changes to the Contract Documents.

14. Coordinate commissioning activities among the CM, GC and NCANG.

15. Attend selected planning and job-site meetings to obtain information on construction progress.

16. Review the TAB execution plan.

17. Oversee all or part of functional testing of the control system and approve it for use by TAB, before TAB is executed.

18. Review FPTs and analyze data to verify performance.
19. Coordinate the resolution of design non-compliance and deficiencies identified in all phases of commissioning.

20. Recommend acceptance of tested systems and equipment commissioned to the CM and DCANG.

21. Review and approve the preparation of the final O&M manuals. Ensure required O&M manuals, instructions and demonstrations are provided to the DCANG's designated operating staff.

22. Review equipment warranties to ensure that the Government's responsibilities are clearly defined.

23. Provide a final commissioning report that will include; an executive summary, list of participants and roles, brief project description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report will contain the disposition of the commissioning authority regarding the adequacy of the equipment. Outstanding non-compliance and deficiencies shall be specifically listed. Appendices shall contain acquired documentation of all completed Cx verification checklists and performance testing, deficiency lists, site visit reports, general findings, unresolved issues, and communications.

1.7 RETESTING AND RE-INSPECTION

1.8 OPERATION OF EQUIPMENT PRIOR TO ACCEPTANCE

END OF SECTION 01 91 13
SECTION 02 41 16 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Salvaging items for reuse by Government.

B. Related Sections: Refer to the following sections associated regarding potential remediation of hazardous materials associated with the Structure Demolition:

1. Section 02 82 33 "Asbestos Abatement."
2. Section 02 83 33 “Lead-Based Paint Removal and Disposal.”
3. Section 02 84 33.12 "Removal and Disposal of Polychlorinated Biphenyls (PCBs) and Mercury Removal."

1.2 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 Government ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Existing Facility Intel Vault and Command Post IDS Equipment and Devices, and CCTV head end equipment and CCTV cameras are to be removed, salvaged, protected, and stored for reuse. Storage location to be located on Charlotte-Douglas ANGB, and final location to be determined by BCE representative. Reinstallation is to be by others and is not part of this contract.

C. 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 Government that may be uncovered during demolition remain the property of Government.
1. Carefully salvage in a manner to prevent damage and promptly return to Government.

1.4 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 Government.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician certified by EPA-approved certification program.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and noise control. Indicate proposed locations and construction of barriers.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

C. 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.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Government prior to start of demolition.

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 01 32 33 "Photographic Documentation." Submit before the Work begins.

F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

G. 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.
1.6 CLOSEOUT SUBMITTALS
A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 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 Contracting Officer and authorities having jurisdiction.
A. Government assumes no responsibility for buildings and structures to be demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Government as far as practical.
B. Hazardous Materials: Hazardous materials are present in building and structure to be demolished. A report on the presence of hazardous materials (Hazardous Materials Survey Report) performed by ECS, dated 18 May 2016, is available as supplemental information. 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. Government 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.
C. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION
A. Arrange demolition schedule so as not to interfere with Government's on-site operations or 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 31 20 00 "Earth Moving."

PART 3 - EXECUTION

3.1 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 Government. Government does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. 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.

3.2 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 Government.
4. Transport items to storage area designated by Contracting Officer.
5. Protect items from damage during transport and storage.
3.3 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. Arrange and coordinate to shut off utilities with Government and utility companies.
2. 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.
3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 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 Government and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Government 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 01 50 00 "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.

3.5 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 2 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 Government 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. Metal Roof Decking: Carefully detach from existing construction in a manner to prevent damage. Re-use of existing decking not permitted.

D. Explosives: Use of explosives is not permitted.

3.6 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 all foundation walls and other below-grade construction.
   1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

D. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
   1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
   2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.
   3. All demolished and removed utilities shall be capped back to the existing main, unless otherwise noted.

E. Hydraulic Elevator Systems: Demolish and remove elevator system, including cylinder, plunger, well assembly, steel well casing and liner, oil supply lines, and tanks.

3.7 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or fill applicable below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 31 20 00 “Earth Moving” as required for new construction.

B. 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.

3.8 REPAIRS

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

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction. See Section 01 74 19 "Construction Waste Management and Disposal" for recycling and disposal of demolition waste.
   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.
3.10 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 02 41 16
SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 DEFINITIONS

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

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. Product Certificates: 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.

C. 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.

D. 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.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Contracting Officer.
1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, & testing agency.

B. Welding certificates.

C. 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. Waterstops.
   6. Curing compounds.
   7. Floor and slab treatments.
  10. Vapor retarders.
   11. Semirigid joint filler.

D. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control 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. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 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.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.8 FIELD CONDITIONS

A. 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 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.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F 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.
PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   
   1. ACI 301.
   2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   
   1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      
      a. Medium-density overlay, Class 1 or better; mill-release agent treated 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 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.


E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   

G. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   
   1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, leave holes no larger than 1 inch 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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

E. Deformed-Steel Wire: ASTM A 1064/A 1064M.

F. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. 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.

2.5 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Regional Materials: Concrete shall be manufactured within 500 miles of Project site.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. Cementitious Materials:

2. Fly Ash: ASTM C 618, Class F or C.

E. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse Aggregate Size: 1 inch nominal typically and 1 1/2 inch (37.5 mm) nominal at footings.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

F. Air-Entraining Admixture: ASTM C 260/C 260M.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do 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.

H. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
   1. Color: As selected by Architect from manufacturer's full range.


2.6 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.

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.

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.

D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.
2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.8 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

   a. BASF Corporation; Admixture Systems.
   b. Dayton Superior.
   c. Euclid Chemical Company (The); an RPM company.
   d. Kaufman Products, Inc.
   e. L&M Construction Chemicals, Inc.
   f. W. R. Meadows, Inc.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. BASF Corporation; Admixture Systems.
      b. Dayton Superior.
      c. Euclid Chemical Company (The); an RPM company.
      d. Kaufman Products, Inc.
      e. L&M Construction Chemicals, Inc.
      f. W. R. Meadows, Inc.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. BASF Corporation; Admixture Systems.
      b. Dayton Superior.
c. Euclid Chemical Company (The); an RPM company.
d. Kaufman Products, Inc.
e. L&M Construction Chemicals, Inc.
f. W. R. Meadows, Inc

2.10 RELATED MATERIALS


B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 according to ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, 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 IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch-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 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 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: Use fly ash as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing 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 w/c ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

B. Walls: Normal-weight concrete.
1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

C. Slabs-on-Grade & Elevated Slabs on Steel Decking: Normal-weight concrete.

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd..
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

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 347 as abrupt or gradual, as follows:

   2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.
E. Construct 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 ITEM INSTALLATION

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 303.
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.

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 for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 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 is not 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 Contracting Officer.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 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-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 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/D 1.4M, 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.

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 Contracting Officer.

   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 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 or epoxy-coated adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces as directed.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints as follows:

   1. Grooved Joints (at locations indicated on drawings): Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. 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 minimum 1/8-inch-wide joints into concrete when cutting action does 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 or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "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 WATERSTOP INSTALLATION

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 are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Contracting Officer.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is 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 not to 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 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.

D. 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.
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.

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. Provide rubbed finish per the following:

1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 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 matches 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.

2. Apply to concrete surfaces exposed to public view.

C. 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 in one direction.

1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
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 to receive trowel finish.

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 exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
   a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs on grade (this does not include elevated slabs on steel decking).
   b. At elevated slabs on steel decking, finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

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, 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 Contracting Officer before application.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 4500 psi at 28 days.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 12-inch centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
   6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported 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 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 remainder of 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 lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less 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 does 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. Recope areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.14 LIQUID FLOOR TREATMENT APPLICATION
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 the minimum age prescribed by the liquid floor treatment manufacturer.
   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 joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints as indicated 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 Contracting Officer. Remove and replace concrete that cannot be repaired and patched to Contracting Officer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 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 in any dimension to solid concrete. Limit cut depth to 3/4 inch. 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 matches 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 Contracting Officer.

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 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 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 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 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 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 Contracting Officer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Contracting Officer's approval.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. 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.
8. Refer to Section 01 45 35 SPECIAL INSPECTIONS for additional information.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. **Testing Frequency:** Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
   
a. When frequency of testing provides 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.

2. **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.

3. **Air Content:** ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. **Concrete Temperature:** ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. **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.

6. **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.

7. 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.

8. **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.

9. **Test Results:** Shall be reported in writing to Contracting Officer, 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.

10. **Nondestructive Testing:** Impact hammer, sonoscope, or other nondestructive device may be permitted by Contracting Officer but will not be used as sole basis for approval or rejection of concrete.

11. **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 Contracting Officer. 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 Contracting Officer.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00
SECTION 04 20 00 - 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.

1.2 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Decorative concrete masonry units.
   3. Clay face brick.
   4. Building (common) brick.
   5. Mortar and grout.
   6. Steel reinforcing bars.
   7. Masonry-joint reinforcement.
   8. Ties and anchors.
   9. Embedded flashing.
   10. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:
   1. Cast-stone trim in unit masonry.
   2. Steel lintels in unit masonry.
   3. Steel shelf angles for supporting unit masonry.
   4. Cavity wall insulation.

C. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
   2. Section 072100 "Thermal Insulation" for cavity wall insulation.
   3. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

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

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

C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

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

1. Decorative CMUs.
2. Clay face brick, in the form of straps of five or more bricks.
3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Weep holes and cavity vents.
5. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. 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. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.
   a. Include material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.

c. For exposed brick, include test report for efflorescence according to ASTM C 67.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

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

1.7 QUALITY ASSURANCE

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

B. 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 mockups for each type of exposed unit masonry construction in sizes approximately 72 inches long by 72 inches high by full thickness, including face and backup wythes and accessories.

a. Include a sealant-filled joint at least 16 inches long in each mockup.

b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).

c. Include water-resistant barrier air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.

3. Protect accepted mockups from the elements with weather-resistant membrane.
4. 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 Architect specifically approves such deviations in writing.

5. 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. 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. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

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

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches 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 three days after building masonry walls or columns.
UNIT MASONRY

2.1 MANUFACTURERS

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

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

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

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

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
2.3 CONCRETE MASONRY UNITS

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

B. Regional Materials: CMUs shall be manufactured within 500 miles of Project site.

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

D. CMUs: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3250 psi.
   2. Density Classification: Normal weight.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
   4. Exposed Faces: As indicated on the Drawings.

E. Decorative CMUs: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3250 psi where unit is a non-veneer part of a structural wall (detailed on Structural drawings), and 2500 psi elsewhere.
   2. Density Classification: Normal weight.
   4. Pattern and Texture:
      a. Standard pattern, ground-face finish.
      b. Standard pattern, split-face finish.
      c. Standard pattern, shot blasted finish.
   5. Colors: As indicated on Drawings.

2.4 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, 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.
2.5 BRICK

A. Regional Materials: Brick shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Regional Materials: Brick shall be manufactured within 500 miles of Project site.

C. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

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 where shapes produced by sawing would result in sawed surfaces being exposed to view.

D. Clay Face Brick: Facing brick complying with ASTM C 216.

1. Grade: SW.
2. Type: FBX.
3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
7. Application: Use where brick is exposed unless otherwise indicated.


2.6 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150/C 150M, 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.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

C. Hydrated Lime: ASTM C 207, Type S.
D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: Not permitted.

F. Mortar Cement: ASTM C 1329/C 1329M.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Davis Colors.
   b. Euclid Chemical Company (The); an RPM company.
   c. Lanxess Corporation.

H. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Essroc.
      2) Holcim (US) Inc.
      3) Lafarge North America Inc.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
4. Pigments shall not exceed 5 percent of mortar cement by weight.

I. Aggregate for Mortar: ASTM C 144.

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

K. 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.

L. Water: Potable.

2.7 REINFORCEMENT

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

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in required position within cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
   2. Wire Size for Side Rods: 0.187-inch diameter.
   5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.


E. Masonry-Joint Reinforcement for Multiwythe Masonry:
   1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus two side rods at each wythe of masonry 4 inches wide or less.
   2. Tab type, ladder design, with one 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 cover on outside face.
   3. Adjustable (two-piece) type, ladder truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.


2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
6. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.

D. Adjustable Anchors for Connecting to Structural Steel Framing: 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-diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.25-inch-diameter, hot-dip galvanized steel wire.

E. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches 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.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

G. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch-thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.25-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
2.9  EMBEDDED FLASHING MATERIALS

A.  Flexible Flashing: Use one of the following unless otherwise indicated:

1.  Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.

   a.  Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1)  GCP Applied Technologies Inc. (formerly Grace Construction Products).
      2)  Heckmann Building Products, Inc.
      3)  Polyguard Products, Inc.

   b.  Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

   c.  Metal Drip Edge: Fabricate from 0.015 inches thick stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

B.  Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

C.  Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10  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 or PVC, complying with ASTM D 2287, Type PVC-65406 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 felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D.  Weep/Cavity Vent Products: Use the following unless otherwise indicated:

   1.  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 less than depth of outer wythe, in color selected from manufacturer's standard.
E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advanced Building Products Inc.
   b. CavClear/Archovations, Inc.
   c. Heckmann Building Products, Inc.
   d. Mortar Net Solutions.

2. Configuration: Provide one of the following:
   a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.11 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. EaCo Chem, Inc.
   c. ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime mortar.
4. For reinforced masonry, use portland cement-lime mortar.
5. 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.

1. For reinforced masonry, use Type S.
2. For exterior, above-grade, nonload-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N or Type S.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of mortar cement by weight.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

F. 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 TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2500 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

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 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. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

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

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

D. Stopping and Resuming Work: Stop work by stepping 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 CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. 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 clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
   3. Wedge nonload-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 Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

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

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

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

D. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, and air barriers unless otherwise indicated.

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 4.5 sq. ft. of wall area spaced not to exceed 36 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.

   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
   b. Where bed joints of wythes do not align, use adjustable-type (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-type (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 into each wythe. Space headers not more than 8 inches clear horizontally and 16 inches clear vertically.


B. 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.

C. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches 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 ANCHORED MASONRY VENEERS

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

1. Fasten seismic anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.
   1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

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

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

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

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

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

3.10 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 CMUs 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 as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches 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 for installation of sealant and backer rod specified in Section 079200 “Joint Sealants.”

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 “Joint Sealants,” but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND CAVITY 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 cavity 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, and through inner wythe to within 1/2 inch 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 on interior face.

3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

5. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products 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 o.c. unless otherwise indicated.
4. Trim wicking material flush with outside face of wall after mortar has set.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.13 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 that of other loads that may be placed on them during construction.

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

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 TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

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

B. Inspections: Special inspections according to the “International Building Code.”

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

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

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

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

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
3.15 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.
   6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
   7. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.16 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 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 Section 312000 "Earth Moving."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00
SECTION 04 72 00 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast stone trim including the following:
   a. Sills.

B. Related Sections:

1. Section 04 20 00 "Unit Masonry" for installing cast stone units in unit masonry.

1.2 ACTION SUBMITTALS

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

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
3. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.
4. Concrete products should contain a minimum of 15 percent fly ash as part of the cementitious content total to contribute to the product’s overall recycled content. Additional recycled content from slag and other materials is encouraged. Preference should be given to products with components containing high percentages of recycled content, and that are both extracted and manufactured within 500 miles of the project site.

C. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

D. Samples for Initial Selection: For colored mortar.
E. Samples for Verification:
   1. For each color and texture of cast stone required, 10 inches square in size.
   2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.3 INFORMATIONAL SUBMITTALS
A. Qualification Data: For manufacturer and testing agency.
   1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.
B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364.
   1. Provide test reports based on testing within previous two years.

1.4 QUALITY ASSURANCE
A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute or the Precast/Prestressed Concrete Institute for Group A, Category AT.
B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.
D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
E. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

1.5 DELIVERY, STORAGE, AND HANDLING
A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.
B. Pack, handle, and ship cast stone units in suitable packs or pallets.
   1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

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

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

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.


PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

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.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.
1. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.2 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

C. Fabrication Tolerances:
1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

D. Cure units as follows:
1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:
   a. No fewer than five days at mean daily temperature of 70 deg F or above.
   b. No fewer than six days at mean daily temperature of 60 deg F or above.
   c. No fewer than seven days at mean daily temperature of 50 deg F or above.
   d. No fewer than eight days at mean daily temperature of 45 deg F or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

2.3 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 042000 "Unit Masonry."

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

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

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Mortar Cement: ASTM C 1329.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

G. Colored Cement Product: Packaged blend made from portland cement and hydrated lime or mortar cement and mortar pigments, all complying with specified requirements and containing no other ingredients.
   1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
   2. Pigments shall not exceed 10 percent of portland cement by weight.
   3. Pigments shall not exceed 5 percent of mortar cement by weight.

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

I. Water: Potable.
2.4 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
2. Fabricate through-wall metal flashing embedded in masonry from copper, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

B. Dowels: 1/2-inch-diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

C. Fasteners: As designed by the manufacturer.

D. Proprietary Detergent 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 cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.6 MORTAR MIXES

A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

B. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.


1. For setting mortar, use Type S.
2. For pointing mortar, use Type N.

D. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of mortar cement by weight.
3. Mix to match Architect's sample.
E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect’s sample.
2. Application: Use colored aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Section 042000 "Unit Masonry."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 1/4 to 3/8 inch wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.
   1. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
   3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
   6. Clean cast stone with proprietary detergent cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 72 00
SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Field-installed shear connectors.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

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 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. 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. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).

E. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, professional engineer, & testing agency.

B. Welding certificates.

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

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control and special inspection reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Building Fabricator, Category BU.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

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

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

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 corrosion and deterioration.

1. 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.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Combined system of braced frame and shear walls.
2.2 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:

1. W-Shapes: 60 percent.
2. Channels, Angles, M, S-Shapes: 60 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 25 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

C. W-Shapes: ASTM A 992/A 992M.

D. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.

E. Plate and Bar: ASTM A 36/A 36M.

F. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.

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

H. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.

I. Steel Forgings: ASTM A 668/A 668M.

J. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
   1. Finish: Hot-dip or mechanically deposited zinc coating.
   2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 3125, Grade A 325TC, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain or Mechanically deposited zinc coating (at galvanized locations).

E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Plain or Mechanically deposited zinc coating, ASTM B 695, Class 50 (at galvanized locations).

G. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
   4. Finish: Plain or Mechanically deposited zinc coating, ASTM B 695, Class 50 (at galvanized locations).

H. Threaded Rods: ASTM A 36/A 36M.
   3. Finish: Plain or Mechanically deposited zinc coating, ASTM B 695, Class 50 (at galvanized locations).

I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

2.4 PRIMER
   A. Primer: Comply with Division 09 painting sections.
   B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
   C. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.5 GROUT
   A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION
      1. Camber structural-steel members where indicated.
      2. Fabricate beams with rolling camber up.
      3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
      4. Mark and match-mark materials for field assembly.
      5. 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/D1.1M.
   C. Bolt Holes: Cut, drill, 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 3, "Power Tool 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/D1.1M 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 frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate 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.

2.7 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: Snug tightened, except where indicated otherwise on Contract Documents.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 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.
   2. Surfaces to be field welded.
   4. Surfaces to receive sprayed fire-resistant materials (applied fireproofing).
   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 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 minimum dry film thickness of 1.5 mils. 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 surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
2.9 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 and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels & shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M 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 are not accepted.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M 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 according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.


1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-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.
4. 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.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are 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.
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/D1.1M 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.

1. Joint Type: Snug tightened unless otherwise noted.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.
4. Refer to Section 01 45 35 SPECIAL INSPECTIONS for additional requirements.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M 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 are not accepted.

c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M 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 according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 12 00
SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   2. KCS-type K-series steel joists.
   4. LH- series long-span steel joists.
   5. Joist accessories.

1.2 DEFINITIONS

A. SJI's "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 manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:
   1. Include layout, designation, number, type, location, and spacing of joists.
   2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
   3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.
C. Manufacturer certificates.

D. Mill Certificates: For each type of bolt.

E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

F. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

   1. Manufacturer’s responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 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.

1.7 SEQUENCING

A. Deliver steel bearing plates to be built into reinforced concrete masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

   1. Use ASD for data are given at service-load level or LRFD for data are given at factored-load level.

   2. Design special joists to withstand design loads with live-load deflections no greater than the following:

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 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. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Camber joists according to SJI's "Specifications."

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specification 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 follows:

2. End Arrangement: Underslung.
3. Top-Chord Arrangement: Parallel.

B. Provide holes in chord members for connecting and securing other construction to joists.

C. Camber long-span steel joists according to SJI's "Specifications."

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.
2.4 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15. Where joists will be exposed in the final construction, primers utilized shall meet all requirements for compliance with Division 09 painting sections.

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 from ASTM A 36/A36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

C. Furnish 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 of finished wall surface unless otherwise indicated.
   1. Finish: Plain, uncoated.

D. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade 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.

E. Welding Electrodes: Comply with AWS standards.

F. Galvanizing Repair Paint: ASTM A 780/A 780M.

G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

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 materials.

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 thick, or as required for compliance with Division 09 painting sections.
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 of the Work.

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 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. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates and framework. 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 or Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

E. 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: Engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

   1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:
a. Liquid Penetrant Inspection: ASTM E 165/E 165M.
b. Magnetic Particle Inspection: ASTM E 709.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

E. Refer to Section 01 45 35 SPECIAL INSPECTIONS for additional requirements.

3.4 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. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.

2. Apply a compatible primer of same type as primer used on adjacent surfaces.

END OF SECTION 05 21 00
SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck, from ICC-ES.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

2. Deck Profile: As indicated.

3. Profile Depth: As indicated.

4. Design Uncoated-Steel Thickness: As indicated.

5. Span Condition: Triple span or more.


2.3 COMPOSITE FLOOR DECK

A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Fy = 50 ksi, G30 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.

2. Profile Depth: As indicated.

3. Design Uncoated-Steel Thickness: As indicated.

4. Span Condition: Triple span or more.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 14 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

I. Galvanizing Repair Paint: ASTM A 780/A 780M.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer’s written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer’s written instructions. Provided signed and seal calculations by a Professional Engineer illustrating that the proposed fasteners strength and attachment pattern exceeds the strength of the fasteners and attachment pattern indicated on the drawings. Calculations shall evaluate both diaphragm shear and uplift conditions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated, and as follows:

2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated on the drawings, and as follows:

1. Mechanically fasten with self-drilling, No. 14 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.
D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

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:

2. Weld Spacing: Space and locate welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on the drawings, and as follows:

1. Mechanically fasten with self-drilling, No. 14 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.
C. Prepare test and inspection reports.

3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

END OF SECTION 05 31 00
SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Ceiling joist framing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

D. Delegated-Design Submittal: For cold-formed steel framing and connections. Submit signed and sealed calculations and signed and sealed drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, licensed in the State of North Carolina, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing and connections to the structure capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads shall be in accordance with the International Building Code 2012, Unified Facilities Criteria UFC 3-301-01, and Unified Facilities Criteria UFC 4-010-01.
   2. ATFP Blast loads:
      a. Per UFC 4-010-01 with Weight II at 30 feet standoff distance (unless noted otherwise).

c. Building is located within a controlled perimeter.

3. Deflection Limits for Conventional Loading: Design framing systems to withstand design loads without deflections greater than the following:

a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.

b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 (1/600 for framing supporting masonry veneer) of the wall height. (Response limits for blast loading are as prescribed by the USACE Protective Design Center for the component type and required Level of Protection.)

c. Ceiling Joist & Soffit Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

4. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Upward and downward movement of 1 inch.

6. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:

2. Wall Studs: AISI S211.
3. Headers: AISI S212.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2.2 COLD-FORMED STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60, A60, AZ50, or GF30.

C. Steel Sheet for Vertical Deflection & Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0451 inch.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: 0.0451 inch.
   2. Flange Width: 1 inch plus twice the design gap for other applications.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
COLD-FORMED METAL FRAMING

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges
designed to support horizontal loads and transfer them to the primary structure, and as
follows:
   a. Minimum Base-Metal Thickness: 0.0451 inch.
   b. Flange Width: 1 inch plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated, and as follows:
   a. Minimum Base-Metal Thickness: 0.0451 inch.
   b. Flange Width: Insert dimension equal to sum of outer deflection track flange
width plus 1 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from
upward and downward vertical displacement and lateral drift of primary structure through
positive mechanical attachment to stud web and structure.

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated,
punched with standard holes, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0346 inch.

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths
indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0451 inch.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A1003/A1003M, Structural
Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise
indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
9. Joist hangers and end closures.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to
   ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-
   steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to
   ASTM A 153/A 153M, Class C or mechanically deposition according to ASTM B 695,
   Class 50.

C. 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 conducted by a qualified
   testing agency.

D. 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.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping,
   steel drill screws.

   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404.
   Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for
   placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout
   containing selected silica sands, portland cement, shrinkage-compensating agents, and
   plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid
   consistency and 30-minute working time.
D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing 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. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer’s written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
G. Install insulation, specified in Division 7 section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: 16 inches, unless otherwise indicated or required by analysis.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single deep-leg deflection tracks and anchor to building structure.
   2. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
   4. Connect drift clips to cold-formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
      a. Install solid blocking at 96-inch centers, unless otherwise indicated or required by analysis.
   2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports. Refer to Section 01 45 35 SPECIAL INSPECTIONS for additional information and requirements.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00
SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel framing and supports for mechanical and electrical equipment.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Steel framing and supports for operable partitions.
   4. Shelf angles.
   5. Metal ladders.
   6. Metal bollards.
   7. Loose bearing and leveling plates for applications where they are not specified in other Sections.

1.2 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 metal fabrications that are anchored to or that receive other work. 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.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Grout.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
C. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:

1. Steel framing and supports for mechanical and electrical equipment.
   a. For HVAC units, equipment and accessories as called for in other sections.
   b. Utility distribution reels and other equipment not specifically ground or wall mounted.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Steel framing and supports for operable partitions.
4. Shelf angles.
5. Metal ladders.
6. Metal bollards.
7. Loose steel lintels.

D. Delegated-Design Submittal: For ladders, HVAC unit supports, accessories, and other equipment including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Structural Performance: Hangers and supports for equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
2. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

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

1.5 QUALITY ASSURANCE

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

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

B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: 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.

F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

2.4 MISCELLANEOUS MATERIALS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public 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."

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. 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.

D. Safety Chains: Safety chains shall be galvanized welded steel, proof coil chain tested in accordance with ASTM A 467, Class CS. Safety chains shall be straight link style, 1/4-inch diameter, minimum 12 links per foot and with bolt type snap hooks on each end. Eye bolts for attachment of chains shall be galvanized 3/8-inch bolt with 3/4-inch eye, anchored as indicated. Two chains shall be furnished for each guarded opening.

E. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 4500 psi.
2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

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

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. Aluminum Ladders:

1. Basis-of-Design Product: Subject to compliance with requirements, provide aluminum ladder as manufactured by O’Keeffe’s Inc. for the following configurations:

   4) Aluminum Roof Access Ladder: O’Keeffe’s Inc Model 531 – LD-4

   b. ACL Industries, Inc.
   c. Alco-Lite Industrial Products.
   d. Halliday Products.
   e. Precision Ladders, LLC.
f. Royalite Manufacturing, Inc.
g. Thompson Fabricating, LLC.

2. Space siderails 18 inches apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
5. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
6. Provide platforms as indicated; fabricated from pressure-locked aluminum bar grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 1/2 inch in least dimension.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with manufacturer’s standard bolted aluminum brackets.
8. Provide with manufacturer’s OSHA approved fall arrest system equal to O’Keeffe’s SAF-T-CLIMB Kit and Post at ladders accessing roof hatch.

2.9 INCLINED SHIP LADDER

A. Type: Fixed, inclined, aluminum, standard ship ladder with railings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide O’Keeffe’s Inc. aluminum ship ladder Model 520 (mill finish) – LD-5.
   a. ACL Industries, Inc.
   b. Alco-Lite Industrial Products.
   c. Halliday Products.
   d. Precision Ladders, LLC.
   e. Royalite Manufacturing, Inc.
   f. Thompson Fabricating, LLC.

B. Comply with ANSI A14.3.

C. Accommodation height: Field verify approximately 14 feet 0 inches.

D. Angle of inclination: 60 degrees (field verify).

E. Treads: 6 inches wide by 1/3-4 inches deep by 24 inches wide aluminum channel shaped section with corrugated surface.
   1. Equally space treads.
   2. Connect treads to stringers with bolts to allow for future replacement.

F. Stringers: 6 by 2 inches aluminum channel.

G. Handrail: Fabricate from 1-1/4 inches diameter aluminum pipe.
   1. Form returns with 6 inches radius.
2. Attach rail to stringer with pipe sections spaced at approximately 30 inches such that rail projects approximately 6 inches above stringer.
3. Locate bottom of handrail 36 inches above floor.
4. Extend rail above ladder such that top of rail is 42 inches above roof access door platform.

H. Ship Ladder Seismic Bottom Support: Manufacturer’s standard; two isolation bearings per stringer.

2.10 MISCELLANEOUS TRIM

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

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

2.11 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.
   1. Cap bollards with 1/4-inch-thick steel plate.
   2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
   3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.

B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
   1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Fabricate sleeves for bollard anchorage from Schedule 80 steel pipe with 1/4-inch-thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.

E. Prime bollards with zinc-rich primer and finish with safety yellow paint.
2.12 LOOSE BEARING AND LEVELING PLATES
A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
B. Galvanize plates.

2.13 LOOSE STEEL LINTELS
A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
C. Galvanize loose steel lintels located in exterior walls.

2.14 STEEL WELD PLATES AND ANGLES AT CEILING FOR TOILET PARTITIONS
A. Provide steel weld plates and angles not specified in other Sections, for items supported from construction as needed to complete the Work.

2.15 FINISHES, GENERAL
A. Finish metal fabrications after assembly.
B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL AND IRON FINISHES
A. 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.
B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

2.17 ALUMINUM FINISH
A. Mill finish.
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. 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.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers’ written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for hanger doors, HVAC unit, equipment supports, and operable partitions securely to, and rigidly brace from, building structure.
3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Fill bollards solidly with concrete, mounding top surface to shed water.
   1. Do not fill removable bollards with concrete.

3.4 INSTALLING BEARING AND LEVELING PLATES


B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the 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 dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00
SECTION 05 51 13 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs and railings.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.

2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings so wall attachments are made only to completed walls.

1. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

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

1. Shop primer products.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental product declaration.
3. **Product Certificates**: 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.

C. **Shop Drawings**:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
   3. Include plan at each level.

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

1.4 **INFORMATIONAL SUBMITTALS**

A. **Qualification Data**: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. **Welding certificates**.

1.5 **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."

1.6 **DELIVERY, STORAGE, AND HANDLING**

A. **Store materials** to permit easy access for inspection and identification.
   1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
   2. Protect steel members and packaged materials from corrosion and deterioration.
   3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
      a. Repair or replace damaged materials or structures as directed.
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, including attachment to building construction.

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 Live Load: 100 lbf/sq. ft..
2. Concentrated Live Load: 300 lbf applied on an area of 4 sq. in..
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, whichever is less.

C. 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: 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. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.
B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

2.4 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. 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.

2.5 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. Assemble stairs and railings in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. 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 Finish #1 - No evidence of welded joint.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers as indicated on Drawings.
   a. Stringer Size: Steel channel or HSS tube sections not less than 12 inches deep, and as required by analysis.
   b. Provide closures for exposed ends of channel and rectangular tube stringers.
   c. Finish: Painted.

2. Construct platforms of steel headers and miscellaneous framing members as indicated on Drawings.
   a. Provide closures for exposed ends of channel and rectangular tube framing.
   b. Finish: Painted.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.
   a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

5. 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. Steel Sheet: Uncoated, hot-rolled steel sheet.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
3. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.

2.7 FABRICATION OF STAIR RAILINGS
   A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

2.8 FINISHES
   A. Finish metal stairs after assembly.
   B. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
   C. 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 EXAMINATION
   A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
      1. 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.
   a. Clean bottom surface of plates.
   b. Set plates for structural members on wedges, shims, or setting nuts.
   c. Tighten anchor bolts after supported members have been positioned and plumbed.
   d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
      1) Neatly finish exposed surfaces; protect grout and allow to cure.
      2) Comply with manufacturer’s written installation instructions for shrinkage-resistant grouts.

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.
   1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
   2. 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.
   3. Comply with requirements for welding in “Fabrication, General” Article.

F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

3.3 REPAIR

A. 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."

END OF SECTION 055113
SECTION 05 51 19 - METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Industrial Class stairs with steel-grating treads.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs.
   1. 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.
   2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

1.3 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:
   1. Gratings.
   2. Shop primer products.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Environmental product declaration.
   3. Product Certificates: 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.

C. Shop Drawings:
1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.

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

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
B. Welding certificates.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: Fabricator of products.
B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING
A. Store materials to permit easy access for inspection and identification.
   1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
   2. Protect steel members and packaged materials from corrosion and deterioration.
   3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
      a. Repair or replace damaged materials or structures as directed.

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, including attachment to building construction.
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 Live Load: 100 lbf/sq. ft.
2. Concentrated Live Load: 300 lbf applied on an area of 4 sq. in.
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.

C. 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: 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. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
   1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
   1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Steel Wire Rod for Grating Crossbars: ASTM A 510/A 510M.
   1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
   1. Select fasteners for type, grade, and class required.
B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

2.4 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. 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.

D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, 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. Assemble stairs in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. 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. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #3 - Partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that are exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel plates or channels.
   a. Stringer Size: As indicated on Drawings.
   b. Provide closures for exposed ends of channel stringers.
   c. Finish: Painted.

2. Construct platforms and tread supports of steel headers and miscellaneous framing members as indicated on Drawings.
   a. Provide closures for exposed ends of channel framing.
   b. Finish: Painted.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.
   a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
1. Fabricate treads and platforms from welded steel or pressure-locked steel grating with minimum 1-1/4-by-3/16-inch bearing bars at 15/16 inch o.c. and crossbars at 4 inches o.c.

2. Fabricate treads and platforms from welded steel or pressure-locked steel grating with openings in gratings no more than 1/2 inch in least dimension.
   a. Surface: Serrated.
   b. Finish: Painted.

3. Fabricate grating treads with cast-abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections.
   a. Secure treads to stringers with bolts.

4. Fabricate grating platforms with nosing matching that on grating treads.
   a. Secure grating to platform framing by welding.

D. Risers: Open.

E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.
   1. Material and Finish: Steel plate to match finish of other steel items.
   2. Fabricate to dimensions and details indicated.

2.7 FABRICATION OF STAIR RAILINGS

A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
   1. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."

C. 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 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
   
   1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

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

3.2 INSTALLING METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
   
   1. 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.
   
      
      a. Clean bottom surface of baseplates.
      b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
      c. After stairs have been positioned and aligned, tighten anchor bolts.
      d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
      e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
         
         1) Neatly finish exposed surfaces; protect grout and allow to cure.
         2) Comply with manufacturer’s written installation instructions for shrinkage-resistant grouts.

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.
1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

2. 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.

3. Comply with requirements for welding in "Fabrication, General" Article.

3.3 REPAIR

A. 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."

END OF SECTION 05 51 19
SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe and tube railings.
   2. Aluminum pipe and tube railings.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
   1. Steel: 72 percent of minimum yield strength.
   2. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
   3. Stainless Steel: 60 percent of minimum yield strength.

C. Structural Performance: 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. applied in any direction.
      b. Concentrated load of 200 lbf 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 applied horizontally on an area of 1 sq. ft..
      b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer’s product lines of mechanically connected railings.
   2. Railing brackets.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

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

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

C. Welding certificates.

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

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

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

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

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
1.6 PROJECT CONDITIONS

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

1.7 COORDINATION AND SCHEDULING

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.

PART 2 - PRODUCTS

2.1 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.

2.2 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A 500 (cold formed).

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.
2.3 ALUMINUM

A. Aluminum, General: Provide 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 alloy and temper designated below for each aluminum form required.

B. Extruded Tubing: ASTM B 221, Alloy 6063-T5/T52.

C. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

2.4 FASTENERS

A. General: Provide the following:

1. 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.

2. Aluminum Railings: Type 316 stainless-steel fasteners.

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.

2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

3. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

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, 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, Class Fe/Zn 5, unless otherwise indicated.


2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

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. 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. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.


2.6 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. Assemble railings in the shop 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 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 will be exposed to weather in a manner to exclude 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 either welded or nonwelded 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. Bend members in jigs to produce uniform curvature for each 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 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 steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

E. Aluminum Finish: Mill.

2.8 STEEL AND IRON FINISHES

A. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

B. 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.

C. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 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.

1. Do not apply primer to galvanized surfaces.


1. Color: As selected by Contracting officer from manufacturer's full range.
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 have been 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 have been 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.

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.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

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. 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.

B. 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 beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch 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.

### 3.5 Attaching Railings

A. Attach railings to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. 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 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.

### 3.6 Adjusting and Cleaning

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

B. 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 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

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

### 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 05 52 13
SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.3 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. Product Certificates: 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.
   3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
1.4 INFORMATIONAL SUBMITTALS

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

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
4. Post-installed anchors.
5. Metal framing anchors.

1.5 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.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.
2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with 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 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.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

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 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 D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated including the following:

1. Framing for raised platforms.
2. Concealed blocking.
3. Roof framing and blocking.
4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
5. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
5. Furring.

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.

C. Concealed Boards: 19 percent maximum moisture content of any of the following species and grades:
1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods, No. 2 Common grade; NELMA.
5. Northern species, No. 2 Common grade; NLGA.
6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

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 nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

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. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. 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.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. 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 o.c.

G. 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.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.
I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   2. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD 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.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53
SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Interior deck sheathing / underlayment.
3. Parapet sheathing.

1.2 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. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
2. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:

2. Chain-of-Custody Qualification Data: For manufacturer and vendor.
3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
4. Product Data: For installation adhesives, indicating VOC content.

1.3 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. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corporation.
   b. Continental Building Products, LLC.
   c. Georgia-Pacific Building Products.
   e. USG Corporation.

2. Type and Thickness: Regular, 1/2 inch thick.

2.3 INTERIOR DECK SHEATHING / UNDERLAYMENT


2. Nominal Thickness: Not less than 15/32-inch.
2.4 PARAPET SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Georgia-Pacific Building Products.
      c. National Gypsum Company.
      d. USG Corporation.
   2. Type and Thickness: Regular, 1/2 inch thick.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For roof parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M of Type 304 stainless steel.
   2. For roof parapet and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

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.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
   1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
   2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.
2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

B. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Use common wire 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. Install fasteners without splitting wood.

E. Coordinate wall parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.
3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 16 00
SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product high-pressure decorative laminate adhesive for bonding plastic laminate and cabinet hardware and accessories.

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. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
3. Product Data for Credit MR 6: For products containing rapidly renewable materials, documentation indicating percentages by weight of rapidly renewable content. Include statement indicating cost for each product documented.
4. Product data and certificates for Credit MR 7: Chain-of-custody certificates indicating that permanently installed products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product and itemized receipts showing all relevant chain-of-custody certificate numbers.
5. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.
6. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that product contains no added urea formaldehyde.

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 plastic-laminate cabinets.
   4. Apply W1 Certified Compliance Program label to Shop Drawings.
   5. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Initial Selection:
   1. Plastic laminates.
   2. PVC edge material.
   3. Thermoset decorative panels.

1.4 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.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products and Certified participant in AWI's Quality Certification Program.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
1.6 DELIVERY, STORAGE, AND HANDLING
   A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS
   A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
   B. 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.
   C. 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.

1.8 COORDINATION
   A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS
   A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
      1. Provide certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   B. Grade: Custom.
C. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

D. Regional Materials: Wood products shall be manufactured within 500 miles of Project site.

E. Type of Construction: Frameless.

F. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

H. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade HGS.
   4. Edges: Grade HGS.
   5. Pattern Direction: Horizontally for drawer fronts, doors, and fixed panels.

I. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
      b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
      c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
   2. Drawer Sides and Backs: Solid-hardwood lumber.
   3. Drawer Bottoms: Hardwood plywood.

J. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

K. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

L. 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.

M. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Match colors and finish as indicated on the Material Legend Drawing.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

C. Composite Wood Products: Products shall be made without urea formaldehyde.

D. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
4. Softwood Plywood: DOC PS 1, medium-density overlay.
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.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

F. Drawer Slides: BHMA A156.9.
1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
2. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
3. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.

G. Door and Drawer Silencers: BHMA A156.16, L03011.

H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Stainless Steel: BHMA 630.

I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate cabinets to dimensions, profiles, and details indicated.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

   1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

   2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with toggle bolts through metal backing or metal framing behind wall finish.
3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 41 16
SECTION 06 64 00 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

   1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   3. Product Data: For sealants, indicating VOC content.
   4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.
2.2 PLASTIC SHEET PANELING


1. Manufacturers: Subject to compliance with requirements, 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:
   a. Crane Composites, Inc.
   b. Glasteel.
   c. Marlite.
   d. Newcourt, Inc.
   e. Nudo Products, Inc.
   f. Parkland Plastics, Inc.

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

3. Nominal Thickness: Not less than 0.09 inch.
4. Surface Finish: Smooth
5. Color: White

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: White

B. Adhesive: As recommended by plastic paneling manufacturer.

1. Adhesives shall have a VOC content of 50 g/L or less.

C. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

1. Sealant shall have a VOC content of 250 g/L or less.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
   1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
   2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive. Do not fasten through panels.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00
SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

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. Modified bituminous sheet waterproofing.
      2. Blindside sheet waterproofing.

1.3 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.
      1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
      2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

   B. LEED Submittals:
      1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
      2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
3. Product Data for Credit MR 6: For products containing rapidly renewable materials, documentation indicating percentages by weight of rapidly renewable content. Include statement indicating cost for each product documented.

4. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.

C. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

D. Samples: For each exposed product and for each color and texture specified, including the following products:

1. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.
2. 4-by-4-inch (100-by-100-mm) square of drainage panel.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.

   a. Size: 100 sq. ft. (9.3 sq. m) in area.
   b. Description: Each type of wall installation.

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 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
   1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form, on warranty form at end of this Section, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
   1. Basis-of-Design Product: GCP Applied Technologies, Inc. (formerly Grace Construction Products); Bituthene 3000 Below Grade Vertical Application. Subject to compliance with requirements, provide the specified product or a comparable product by one of the following:
      b. Henry Company; Blueskin WP 200.

   2. Physical Properties:
a. Tensile Strength, Membrane: 325 psi minimum; ASTM D 412, Die C, modified.
b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836/C 836M.
e. Puncture Resistance: 50 lbf minimum; ASTM E 154/E 154M.
f. Water Absorption: 0.10 percent weight-gain maximum after 72-hour immersion at 70 deg F (21 deg C); ASTM D 570.
g. Water Vapor Permeance: 0.05 perm (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
h. Hydrostatic-Head Resistance: 200 feet (60 m) minimum; ASTM D 5385.


B. Blindside Sheet Waterproofing for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the following physical properties:

1. Physical Properties:
   b. Peel Adhesion to Concrete: 5 lbf/in. (875 N/m) minimum; ASTM D 903, modified.
   c. Lap Adhesion: 2.5 lbf/in. minimum; ASTM D 1876, modified.
   d. Hydrostatic-Head Resistance: 230 feet (70 m); ASTM D 5385, modified.
   e. Puncture Resistance: 231 lbf minimum; ASTM E 154/E 154M.
   f. Water Vapor Permeance: 0.1 perm (6 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
   g. Ultimate Elongation: 335 percent minimum; ASTM D 412, modified.

C. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.3 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm), predrilled at 9-inch (229-mm) centers.

G. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:

1. Thickness: Nominal 1/8 inch (3 mm) for vertical applications; 1/4 inch (6 mm) elsewhere.
2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

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 waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.

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

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).

   F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

   1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
      a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

   G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

   A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and per recommendations in ASTM D 6135.

   B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

   C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

   1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

   D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths, to provide a minimum of two thicknesses of sheet membrane over areas to receive waterproofing.

   E. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

   F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

   G. Seal edges of sheet-waterproofing terminations with mastic.

   H. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

   I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
J. Immediately install protection course with butted joints over waterproofing membrane.
   1. Board insulation may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.4 BLINDSIDE SHEET-WATERPROOFING APPLICATION

A. Install blindside sheet waterproofing according to manufacturer's written instructions.

B. Vertical Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.
   1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detail tape.

C. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

D. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

E. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

F. Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches (150 mm) beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish reports to Architect and Construction Manager. Inspect blindside sheet waterproofing preparation and vertical application of sheet waterproofing.

3.6 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.
B. Protect waterproofing from damage and wear during remainder of construction period.

C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

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

END OF SECTION 071326
SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Laboratory Test Reports: For Insulation, indicating compliance with requirements for low-emitting materials.

1.3 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.

1.4 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 IVASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Owens Corning.

2.2 GLASS-FIBER BLANKET

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

B. Glass-Fiber Blanket, Unfaced, Sound Attenuation Blankets: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed Corporation.
   b. Guardian Building Products, Inc.
   c. Johns Manville; a Berkshire Hathaway company.
   d. Knauf Insulation.
   e. Owens Corning.

2.3 MINERAL-WOOL BLANKETS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

B. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Industrial Insulation Group, LLC (IIG-LLC).
   b. Roxul Inc.
   c. Thermafiber, Inc.; an Owens Corning company.

2.4 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.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AGM Industries, Inc.
      b. Gemco.

   2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-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 square or in diameter.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:

   1. 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.

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 36 inches 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 36 inches 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 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 04200 "Unit Masonry."

3.6 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.

3.7 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 07 21 00
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vapor-retarding, fluid-applied air barriers.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Sustainable Design Submittals:
   1. Product Data: For coatings, indicating VOC content.

C. Shop Drawings: For air-barrier assemblies.
   1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

B. VOC Content: 250 g/L or less.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 LOW-BUILD AIR BARRIERS, VAPOR RETARDING

A. Low-Build, Vapor-Retarding Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 6 to 15 mils over smooth, void-free substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Polyguard Products, Inc.
   b. TK Products.
   c. Henry Company

2. Physical and Performance Properties:
   a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
   b. Vapor Permeance: Maximum 0.1 perm; ASTM E 96/E 96M, Desiccant Method.
   c. Ultimate Elongation: Minimum 350 percent; ASTM D 412, Die C.
   d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.
   e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   f. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.
2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dow Corning Corporation.
   b. GE Construction Sealants; Momentive Performance Materials Inc.
   c. Pecora Corporation.
   d. Tremco Incorporated.

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 substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge isolation joints, expansion joints, and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Low-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
1. Vapor-Retarding, Low-Build Air Barrier: Total dry film thickness not less than 6 mils, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections shall include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.

2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 07 27 26
SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes standing-seam metal roof panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Government, Contracting Officer, Government's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 each type of panel and accessory.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
C. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

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. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Roofing Inspector:
   1. Engage manufacturer’s Roofing Inspector with a minimum 5 years experience inspecting this type of roofing system, size of project, manufacturer's requirements and procedures.
   2. Obtain written Approval of Roofing Inspector's qualifications from Government prior to starting work and services.
   3. Manufacturer’s Roofing Inspector shall provide full-time on-site inspection for installation of this Work.
   4. Manufacturer’s Roofing Inspector shall be present during all roofing operations.
1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. 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. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Solar Reflectance Index: Not less than 29 when calculated according to ASTM E 1980.

C. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for steep-slope roof products.

D. Energy Performance: Provide roof panels with an aged Solar Reflectance Index of not less than 0.64 when tested according to CRRC-1.

E. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Structural Drawings.
2. Other Design Loads: As indicated on Structural Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

F. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 at the following test-pressure difference:


G. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:


H. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

I. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 90.

J. 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 I or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class IA- 120.
2. Hail Resistance: SH.

K. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

L. Roof Fall Arrest System: The metal roof system and its connections shall be designed to transfer the fall arrest loading to the structural steel roof deck.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Centria Architectural Systems, SRS3, or comparable product by one of the following:
   a. Englert Series 3000.
   b. ADP I T Batten.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Nominal Thickness: 0.028 inch (24-gage).
   b. Surface: Smooth.
   c. Exterior Finish: As follows:
1) Basis of Design: Versacor PF.
2) 0.8 mil nominal solid color PVDF top coat.
3) 2.0 mil nominal barrier coat primer.

d. Interior Finish: Manufacturer’s recommended finish.

3. Clips: Manufacturer recommended standard clips to accommodate thermal movement.
   a. Stainless steel.

4. Joint Type: As standard with manufacturer.
5. Panel Coverage: 18 inches.
6. Panel Height: Nominal 3.0 inches.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 40 mils thick, consisting of a slip-resistant rubber, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
   1. Basis of Design: Subject to compliance with requirements, provide Henry, Blueskin RF200TM or an approved equal from one of the following:
      b. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.
   3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II. Provide a minimum thickness as indicated on the drawings.
   1. Provide two layers of insulation if thickness is over 2 inches.

2.5 COVER BOARD

A. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corporation; GlasRoc Sheathing.
   b. Georgia-Pacific Corporation; Dens Deck.
   c. Temple-Inland, Inc; GreenGlass Exterior Sheathing.
   d. USG Corporation; Securock Glass Mat Roof Board.

2.6 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

E. Downspouts: Formed from same material and color as roof panels. Fabricate in 10-foot-long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.
   1. Insulate roof curb with 1-inch-thick, rigid insulation.
G. Panel Fasteners: Self-tapping screws designed to withstand design loads.

H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.7 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels shall be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.
2.8 FINISHES

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

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. Basis of Design: Versacor PF.
   2. 0.8 mil nominal solid color PVDF top coat.
   3. 2.0 mil nominal barrier coat primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 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 insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

D. Install cover boards with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.

1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.4 UNDERLAYMENT INSTALLATION

A. 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 staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

1. Apply self-adhering sheet underlayment over entire roof.

3.5 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment with spacing designed according to manufacturer's recommendations.
5. Install flashing and trim as metal panel work proceeds.
6. Field roll panels, install without joints.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
   4. Watertight Installation:
      a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
      b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
      c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

3.6 ACCESSORY INSTALLATION

A. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

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 as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of
intemeshing hooked flanges, not less than 1 inch 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 not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 2 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Connect downspouts to underground drainage system where indicated.

E. Roof Curbs: Install flashing around bases where they meet metal roof panels.

F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.9 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
END OF SECTION 07 41 13.16
SECTION 07 42 13.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exposed-fastener, lap-seam metal wall panels.
   2. Metal liner panels.

B. Related Sections:
   1. Section 074213.19 "Insulated Metal Wall Panels" for foamed-in-place insulated metal wall panels.
   2. Section 074213.23 "Metal Composite Material Wall Panels" for metal-faced composite wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Government, Contracting Officer, Government's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review special siding details, wall penetrations, openings, and condition of other construction that affects metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal panel assembly during and after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 each type of panel and accessory.

B. Sustainable Design Submittals:
   1. **Product Data:** For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, closures, and accessories; and special details.
   2. **Accessories:** Include details of the trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
   1. **Metal Panels:** 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

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. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. 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. Retain strippable protective covering on metal panels during installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Other Design Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS (MP-4)

A. General: Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Basis-of-Design Product: Subject to compliance with requirements, provide CENTRIA Profile Series Econolap 1/2" Exposed Fastener System or comparable product by one of the following:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alcoa Architectural Products (USA).
   b. Englert, Inc.
   c. Fabral.
   d. Flexospan Steel Buildings, Inc.
   e. MBCI; a division of NCI Group, Inc.
   f. Metal Sales Manufacturing Corporation.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Nominal Thickness: 0.022 inch.
   c. Color: As indicated on drawings.

3. Rib Spacing: 2.67 inches o.c.
4. Panel Coverage: 37.3 inches.
5. Panel Height: 0.5 inch.

2.3 METAL LINER PANELS (MP-5)

A. General: Provide factory-formed metal liner panels designed for interior side walls and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for a complete installation.

A. Basis-of-Design Product: Subject to compliance with requirements, provide CENTRIA Profile Series Quietwall System or comparable product by one of the following:
1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   a. Alcoa Architectural Products (USA).
   b. Englert, Inc.
   c. Fabral.
   d. Flexospan Steel Buildings, Inc.
   e. MBCI; a division of NCI Group, Inc.
   f. Metal Sales Manufacturing Corporation.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Nominal Thickness: 0.022 inch.
   c. Color: As indicated on drawings.

5. Seam Height: 2.0 inches.
6. Acoustical Performance: Where sound-absorption requirement is indicated, fabricate interior liner panels with 1/8-inch-diameter holes uniformly spaced approximately 1000 holes/sq. ft..
   a. NRC of not less than 0.85 when tested according to ASTM C 423.

2.4 **MISCELLANEOUS MATERIALS**

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to provide finished appearance. Locations include, but are not limited to, bases, jambs, corners, endwalls, framed openings, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. Two-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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Install screw fasteners in predrilled holes.
   3. Locate and space fastenings in uniform vertical and horizontal alignment.
4. Install flashing and trim as metal panel work proceeds.
5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
6. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

B. Fasteners:
   1. Steel Panels: Use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
   2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
   3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal trim to fit substrates and achieve waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
3.4 FIELD QUALITY CONTROL

A. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13
SECTION 07 42 13.19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Foamed-insulation-core metal wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Government, Contracting Officer, Government's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal panel assembly during and after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 each type of panel and accessory.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
C. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.
   1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Product Test Reports: For each product, tests performed by a qualified testing agency.
C. Field quality-control reports.
D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
B. 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.
1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 72:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

F. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
2. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
3. Potential Heat: Acceptable level when tested according to NFPA 259.
4. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

2.2 FOAMED-INSULATION-CORE METAL WALL PANELS (MP-1 and MP-2)

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, 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. when tested according to ASTM D 1622.
c. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
d. Shear Strength: 26 psi when tested according to ASTM C 273/C 273M.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: 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. Basis-of-Design Product (MP-1 and MP-2): Subject to compliance with requirements, provide Centria Architectural Systems; Versawall Series 2-inch thick Vertical panels with exposure shown on Drawings, or comparable product by one of the following:
   b. Kingspan Insulated Panels.
   c. MBCI; a division of NCI Group, Inc.

2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Nominal Thickness: 0.028 inch.
      1) Color: As indicated on drawings.
   c. Interior Finish: Siliconized polyester.
      1) Color: As selected by Architect from manufacturer's full range.

4. Panel Thickness: 2.0 inches.
5. Thermal-Resistance Value (R-Value): 14 according to ASTM C 1363.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

   2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.


2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

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

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

    1. 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.

    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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 INSULATED METAL WALL PANEL INSTALLATION

A. General: 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 for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.

B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.

1. Install clips to supports with self-tapping fasteners.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

D. 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 are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Contracting Officer for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

D. Metal wall panels will be considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal composite material wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Government, Contracting Officer, Government's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.

4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.

6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

7. Review temporary protection requirements for metal composite material panel assembly during and after installation.


9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Composite Material Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.

B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite material panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.
1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:


C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL WALL PANELS (MP-3)

A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Centria Formabond or comparable product by one of the following:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alcoa Architectural Products (USA).
   b. ALPOLIC Materials: Mitsubishi Plastics Composites America.
   c. ALUCOBOND: 3A Composites USA, Inc.
   d. CENTRIA Architectural Systems.
   e. Citadel Architectural Products, Inc.
   f. Protean Construction Products, Inc.

C. Aluminum-Faced Composite Wall Panels MP-3: Formed with 0.020-inch-thick, coil-coated aluminum sheet facings.

1. Panel Thickness: 0.236 inch.
2. Core: Standard.

   a. Color: As indicated on drawings.

D. Attachment Assembly Components: Formed from extruded aluminum.
2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, Mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish metal composite material 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. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
   a. Size: As recommended by SMACNA’s "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES
A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
C. Aluminum Panels and Accessories:
   1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite material panels.
2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal composite material panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.
B. Water-Spray Test: After installation, test area of assembly as directed by Contracting Officer for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.

D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.23
SECTION 07 54 19 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered polyvinyl chloride (PVC) roofing system.
2. Roof insulation.
3. Cover board.
4. Walkways.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 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, air barrier 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. Review deck substrate requirements for conditions and finishes, 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, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Sustainable Design Submittals:

1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
2. Product Data: For adhesives and sealants, indicating VOC content.
3. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
4. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation thickness and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with air barrier.

D. Samples for Verification: For the following products:
   1. Roof membrane and flashing, of color required.
   2. Walkway pads or rolls, of color required.

E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:
      a. Submit evidence of compliance with performance requirements.

C. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.

D. Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.
1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is listed in FM Approvals’ RoofNav 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.

1.8 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.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. 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 roof membrane, base flashings, roof insulation, fasteners, cover boards, 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 the Work of this Section, including all components of...
roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.

   1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272/D 4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the wind uplift pressures as indicated on drawings when tested according to FM Approvals 4474, UL 580, or UL 1897.

D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

   1. Fire/Windstorm Classification: Class 1A-120.
   2. Hail-Resistance Rating: SH.

E. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

F. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

G. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

H. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
I. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 POLYVINYL CHLORIDE (PVC) ROOFING

   1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville; a Berkshire Hathaway company; JM PVC FB Fully Adhered System, or a comparable product by one of the following:
      a. Carlisle SynTec Incorporated.
      b. Duro-Last Roofing, Inc.
      c. GAF.
      d. Soprema, Inc.
      e. Versico Incorporated.

2. Membrane Thickness: 60 mils.


B. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants shall comply with the following limits for VOC content:
   a. Plastic Foam Adhesives: 50 g/L.
   b. Gypsum Board and Panel Adhesives: 50 g/L.
   c. Multipurpose Construction Adhesives: 70 g/L.
   d. Fiberglass Adhesives: 80 g/L.
   e. Contact Adhesives: 80 g/L.
   f. PVC Welding Compounds: 510 g/L.
   g. Other Adhesives: 250 g/L.
   h. Single-Ply Roof Membrane Sealants: 450 g/L.
   i. Nonmembrane Roof Sealants: 300 g/L.
   j. Sealant Primers for Nonporous Substrates: 250 g/L.
   k. Sealant Primers for Porous Substrates: 775 g/L.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.
C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard, water based.

E. 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.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

G. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlisle SynTec Incorporated.
   b. GAF.
   c. Insulfoam-a division of Carlisle Construction Materials Inc.
   d. Johns Manville; a Berkshire Hathaway company.

2. Compressive Strength: 20 psi.
4. Thickness:
   b. Upper Layer: 2-1/2 inches.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
3. Slope:
   a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
   b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum board or ASTM C 1278/C 1278M fiber-reinforced gypsum board.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Georgia-Pacific Building Products.
      c. National Gypsum Company.
      d. USG Corporation.

   2. Thickness: 1/2 inch.


2.6 WALKWAYS

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

   1. Size: Approximately 36 by 60 inches.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 27 26 "Fluid-Applied Membrane Air Barriers."

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
B. Comply with roofing system and insulation manufacturer’s written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.
   a. Locate end joints over crests of decking.
   b. 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.
   c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
   e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

   1) Trim insulation so that water flow is unrestricted.

   f. Fill gaps exceeding 1/4 inch with insulation.
   g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   h. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

       1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
       2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

   a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
   b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
   d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
   e. Trim insulation so that water flow is unrestricted.
   f. Fill gaps exceeding 1/4 inch with insulation.
   g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   h. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

       1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
3.5 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.
   a. Trim cover board so that water flow is unrestricted.
3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Mechanically fasten cover board to roof deck

3.6 ADHERED ROOFING INSTALLATION

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
3.7 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 seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Install flexible walkways at the following locations:
   a. Perimeter of each rooftop unit.
   b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
   c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
   d. Top and bottom of each roof access ladder.
   e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
   f. Locations indicated on Drawings.
   g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.

B. Perform the following test:

1. 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.

a. Perform tests before overlying construction is placed.

b. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.

c. Flood each area for 24 hours.

d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

   1) Cost of retesting is Contractor's responsibility.

e. Testing agency shall prepare survey report indicating locations of initial leaks, if any, and final survey report.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

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.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 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: ____________________________________________________________
   2. Address: __________________________________________________________
3. Building Name/Type:_______________________________________
4. Address: ____________________________________________
5. Area of Work: _________________________________________
6. Acceptance Date: ________________
7. Warranty Period: ______________________________________
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 Roofing Installer will, at Roofing Installer's 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 the design wind speed as indicated on the drawings.
   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 07 54 19
SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed low-slope roof sheet metal fabrications.
2. Formed wall sheet metal fabrications.
3. Formed equipment support flashing.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

A. 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. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
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 of termination points and assemblies.
   6. Include details of roof-penetration flashing.
   7. Include details of special conditions.
   8. Include details of connections to adjoining work.

D. Samples for Verification: For each type of exposed finish.
   1. Sheet Metal Flashing: 12 inches 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 long and in required profile. Include fasteners and other exposed accessories.
   3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested and FM Approvals approved.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Sample Warranty: For special warranty.

E. All test results shall be required submittals to the Government.

F. Contractor shall submit qualifications of required Independent Testing and Inspection Agent in advance for Government approval.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are SPRI ES-1 tested and FM Approvals approved, 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. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.

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 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.

1.9 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 years from date of Substantial Completion.

B. Special Warranty Against Wind Uplift: Manufacturer's standard form in which manufacturer agrees to repair damaged or replace sheet metal flashing and trim that shows evidence of deterioration within specified warranty period.

1. Damage caused by Wind Uplift, where wind speeds are less than those specified by the Structural Drawings.
a. Documented occurrences for wind speeds are from National Weather Bureau records for this location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cheney Flashing Company.
2. Fry Reglet Corporation.
3. Heckmann Building Products, Inc.
5. Hohmann & Barnard, Inc.

2.2 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. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

   1. Design Pressure: As indicated on Drawings.

D. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 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 coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:
   a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: Match adjacent roofing material.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils 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.

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, 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: 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. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

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.
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 wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

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. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.


2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.7 ROOF-EDGE DRAINAGE SYSTEMS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

1. Gutter Profile: As indicated on the drawings and according to SMACNA's "Architectural Sheet Metal Manual."
2. Expansion Joints: Lap type.
3. Gutters with Girth up to 15 Inches: Fabricate from the following materials:

   a. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

A. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Fabricated Hanger Style: As indicated on the drawings and according to SMACNA's "Architectural Sheet Metal Manual."
2. Manufactured Hanger Style: As indicated on the drawings and according to SMACNA's "Architectural Sheet Metal Manual."
3. Fabricate from the following materials:

   a. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.
C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

D. Zinc-Coated Steel Finish: Three-coat fluoropolymer.


2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, solder or weld watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: Fig 3-4A according to SMACNA's "Architectural Sheet Metal Manual."
2. Coping-Cap Material: Zinc-coated steel, nominal 0.034-inch thickness.

   a. Finish: Three-coat fluoropolymer.

3. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
4. Face Leg Cleats: Concealed, continuous stainless steel.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.
2. Color: As selected by Architect from manufacturer's full range.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.
2. Color: As selected by Architect from manufacturer's full range.

D. Flashing Receivers: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.
2. Color: As selected by Architect from manufacturer's full range.

E. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.
2. Color: As selected by Architect from manufacturer's full range.
2.9 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.
2. Galvanized Steel: 0.028 inch thick.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are 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 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. 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.

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, 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. Cleats shall be continuous.
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. 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 with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
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 into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, 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.
   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; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
   1. Do not solder metallic-coated steel sheet.
   2. Do not use torches for soldering.
   3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

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.
   1. Fasten gutter spacers to front and back of gutter.
   2. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
   3. Anchor gutter with straps spaced not more than 24 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
   4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 2 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
   1. Provide elbows at base of downspout to direct water away from building.
   2. Connect downspouts to underground drainage system where indicated.
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.
   1. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

3.5 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to meet performance requirements.
   1. Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements.
   2. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.6 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. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

C. 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 over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.7 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.
3.8 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.9 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.10 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as 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.

D. 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 07 62 00
SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof curbs.
   2. Equipment supports.
   3. Roof hatches.

1.2 COORDINATION

A. Coordinate layout and installation of roof accessories with interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AES Industries, Inc.
b. Greenheck Fan Corporation.
c. LMCurbs.
d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
e. Roof Products, Inc.
f. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Refer to Mechanical Drawings. Coordinate load requirements with items being supported.

D. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.
   1. Finish: Two-coat fluoropolymer.
   2. Color: As selected by Architect from manufacturer's full range.

E. Construction:
   1. Curb Profile: Manufacturer's standard compatible with roofing system.
   2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
   3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
   4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange.
   5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
   7. Liner: Same material as curb, of manufacturer's standard thickness and finish.

2.3 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced perimeter metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed structure-mounting flange at bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AES Industries, Inc.
   b. Greenheck Fan Corporation.
   c. LMCurbs.
   d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
e. Roof Products, Inc.
f. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Refer to Mechanical Drawings. Coordinate load requirements with items being supported.

D. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.
   1. Finish: Two-coat fluoropolymer.
   2. Color: As selected by Architect from manufacturer's full range.

E. Construction:
   1. Curb Profile: Manufacturer's standard compatible with roofing system.
   2. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
   3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.

2.4 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashimg and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AES Industries, Inc.
      b. Metallic Products Corp.
      c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      d. O'Keeffe's Inc.
      e. Precision Ladders, LLC.

B. Type and Size: Single-leaf lid, 36 by 36 inches


D. Hatch Material: Zinc-coated (galvanized) steel sheet.
   1. Thickness: 0.079 inch.
   2. Finish: Two-coat fluoropolymer.
   3. Color: As selected by Architect from manufacturer's full range.

E. Construction:
1. Insulation: Polyisocyanurate board.
   a. R-Value: 12.0 according to ASTM C 1363.


3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.

5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

6. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.

7. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, galvanized steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

   1. Provide two-point latch on lids larger than 84 inches.
   2. Provide remote-control operation.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

   1. Height: 42 inches above finished roof deck.
   2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
   3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
   5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
   7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
   8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
   9. Fabricate joints exposed to weather to be watertight.
  10. Fasteners: Manufacturer's standard, finished to match railing system.

   a. Color: As selected by Architect from manufacturer's full range.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
5. Finish: Manufacturer's standard baked enamel or powder coat.

   a. Color: As selected by Architect from manufacturer's full range.

2.5 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Custom Solution Roof and Metal Products.
      b. Menzies Metal Products.
      c. Thaler Metal Industries Ltd.

   2. Metal: Aluminum sheet, 0.063 inch thick.
   3. Diameter: As required.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Custom Solution Roof and Metal Products.
      b. Menzies Metal Products.
      c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      d. Thaler Metal Industries Ltd.

   2. Metal: Aluminum sheet, 0.063 inch thick.
   3. Height: 7 inches
   4. Diameter: As required.
   5. Finish: Manufacturer's standard.

2.6 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

   1. Exposed Coil-Coated Finish: Preapanted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
a. Three-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

2. Concealed Finish: Pretreat with 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.

B. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

D. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.


2.7 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.


2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Roof-Hatch Installation:
1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

2. Attach safety railing system to roof-hatch curb.

3. Attach ladder-assist post according to manufacturer's written instructions.

F. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

G. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00
SECTION 07 72 10 – ROOFTOP FALL ARREST SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes Rooftop Fall Arrest System and related appurtenances.

1.2 SYSTEM DESCRIPTION

A. The Rooftop Fall Arrest System shall allow the user to walk uninterrupted the entire length of the system and provide secure anchorage to arrest a fall by the user. All essential components shall be included as part of the above referenced system, though not specifically stated in the following specifications, so as to provide a complete and fully operational system.

1.3 REFERENCES

A. Occupational Safety and Health Administration (OSHA).
   1. 29CFR 1926 Safety and Health Standards.

B. American Society for Testing and Materials.

1.4 PERFORMANCE REQUIREMENTS

A. General: Manufacture and install rooftop Fall Arrest System to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide Rooftop Fall Arrest System that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

D. The Rooftop Fall Arrest System shall provide fall protection access to all areas of the roof. Capacity shall be for two (2) persons simultaneously.
E. The Rooftop Fall Arrest System shall arrest the workers anywhere along the system and for the purpose of inspecting/cleaning gutters. The system shall also allow the users to walk uninterrupted the entire length of the system without the need to disengage at intermediate connection points.

1.5 SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of Rooftop Fall Arrest System, including plans and elevations. Identify factory vs. field-assembled work. Include the following:

   1. Details for fastening, joining, supporting, and anchoring Rooftop Fall Arrest System components to adjoining work.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of Rooftop Fall Arrest System with performance requirements.

D. Manuals containing visual information indicating proper procedures in the usage of the system, inspection and maintenance requirements.

E. Delegated-Design Submittal: Provide design of the rooftop fall arrest system including personnel full-body harness, lanyards, deceleration devices, lifelines, connectors, and all components necessary to provide adequate protection in accordance with this specification and OSHA/ANSI standards. The system shall be designed by a licensed Professional Engineer. Submit signed and sealed calculations.

   1. The fall arrest system shall be designed and coordinated with the metal roof system as a complete system with a continuous load path to the structural steel roof deck. Attachments shall be provided and designed to transfer the fall arrest loading from the fall arrest components to the standing seam roof system. The metal roof system and its connections shall be designed to transfer the fall arrest loading to the structural steel roof deck.

F. All test results shall be a required submittal to the Government.

G. Contractor shall submit qualifications of any required Independent Testing and Inspection Agent in advance for Government approval.

1.6 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic and performance characteristics. Aesthetics are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by
criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetics, as judged solely by Contracting Officer, except with their written approval. If modifications are proposed, submit comprehensive explanatory data to Contracting Officer for review.

B. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these specifications that all equipment called for under this section shall be supplied by a single source. The Rooftop Fall Protection System supplier shall be responsible for proper and complete installation of this system.

C. The manufacturer shall have installed and had in satisfactory use, a minimum of five (5) installations of the size and type comparable to the unit specified for a five (5) year period.

1.7 COORDINATION

A. Coordinate installation of Rooftop Fall Arrest System with roofing construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Rooftop Fall Arrest System as supplied by Tritech Fall Protection Systems.

1. Rooftop Fall Arrest System: All connectors, cables and bolts shall be manufactured from stainless steel: ASTM A666, Type 316. All connectors shall meet and exceed OSHA/ANSI standards. Fabricated supports required for additional support shall be carbon steel with a corrosion resistant finish.

2. All materials shall be new, and the completed fall protection system shall be the product of one manufacturer regularly engaged in the manufacture of such equipment.

2.2 SYSTEM DESIGN

A. The Rooftop Fall Arrest System shall allow users to walk uninterrupted the entire length of the system without having to unhook from the system to pass through intermediate supports. The system shall be designed to support two (2) users in case of a fall and to restrain the users from reaching the edge of the roof in the event of a fall. The system shall be designed for hands-free operation once the user is properly attached to the system. All components shall be designed by the Fall Protection System supplier and shall meet the applicable requirements of OSHA / ANSI.

B. Description:
1. Horizontal Lifeline: Marine grade stainless steel wire rope 8mm 1X19 with a minimum breaking strength of 10,000 pounds, or Structural Beam.
2. Swaging: The cable shall be swaged in-line with the anchor point and have a slip indicator.
3. Shock Absorber: Load limiting in-line shock absorber to 3,000 pounds for multispans and 4,500 pounds for single span systems. The shock absorber must visually display deployment in the event a load such as a fall has occurred on the system.
4. End Anchors: Type 316 stainless steel end anchors with minimum breaking strength of 10,000 pounds.
5. Transfastener/Trolley: Type 316 stainless steel with a minimum tensile load of 3600 pounds. The transfastener shall allow for easy pass-through of support points without disconnecting from the system.
6. Tension Indicator: The system shall include a tension indicator that will allow the user to physically inspect that the correct cable tension is achieved.
7. Other Components: Corner Assemblies, Turnbuckles and other components shall be Type 316 stainless steel.
8. Deceleration Device: Provide appropriate length lanyards or self-retracting lifelines that meet or exceed applicable standards of OSHA/ANSI.
9. Harness: Provide four (4) full body harnesses with single back D-ring that meet or exceed applicable standards of OSHA/ANSI.
10. Systems shall include life lines, connecting devices, attachment anchors. System shall be installed at a minimum of 8” above the roof surface,

C. Material Control:
1. All system components shall contain serial numbers, permanently stamped or engraved, identifying the specific job and system they are used for. These serial numbers shall be recorded in the system manual as described herein and forwarded to the Government upon completion of the project.

2.3 MISCELLANEOUS MATERIALS
A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.
B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FINISHES
A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

   1. Examine roofs for suitable conditions for manufactured rooftop Fall Arrest System.
   2. Verify that substrate is sound, dry, smooth, clean, and securely anchored.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install Rooftop Fall Arrest System according to manufacturer's written instructions. Anchor Rooftop Fall Arrest System securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete rooftop Fall Arrest system.

   1. Install Rooftop Fall Arrest System with provisions for thermal and structural movement.
   2. Torch cutting of Rooftop Fall Arrest System is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

   1. Coat concealed side of stainless-steel Rooftop Fall Arrest System with bituminous coating where in contact with wood or ferrous metal construction.
   2. Underlayment: Where installing exposed-to-view components of Rooftop Fall Arrest System specialties directly on wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.

C. Install Rooftop Fall Arrest System level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.

D. Install Rooftop Fall Arrest System to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

E. Fasteners: Use fasteners of type and size recommended by manufacturer.

F. Do not load or stress Rooftop Fall Arrest System until all materials and fasteners are properly installed and ready for service.
3.3 OPERATOR TRAINING
   A. Provide a minimum of four (4) hours of user training after system has been installed and proof tested. Training is to be for the users of the system conducted at the installation site. Provide training CD.

3.4 FIELD QUALITY CONTROL
   A. After the safety system is installed and properly tensioned, the safety system manufacturer’s approved authorized representative shall inspect and operate the system and shall make all final adjustments for proper operation.
   B. After the system has been placed into operation, the manufacturer’s authorized representative shall perform proof testing and issue a certificate attesting to the system’s ability to withstand the proof load.

3.5 CERTIFICATION
   A. Each installation shall be certified by a qualified professional engineer and certification shall be submitted with shop drawings.

3.6 CLEANING AND PROTECTION
   A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
   B. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
   C. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 10
SECTION 07 81 00 - APPLIED FIREPROOFING

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 sprayed fire-resistant materials.

1.3 DEFINITIONS
   A. SFRM: Sprayed fire-resistant materials.

1.4 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.
      1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.5 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Sustainable Design Submittals:
      1. Product Data for Credit MR4: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
      2. Product Data for Credit MR5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
      3. Product Data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.
   C. Shop Drawings: Framing plans or schedules, or both, indicating the following:
      1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.6 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Product Certificates: For each type of fireproofing.
C. Evaluation Reports: For fireproofing, from ICC-ES.
D. Preconstruction Test Reports: For fireproofing.
E. Field quality-control reports.

1.7 QUALITY ASSURANCE
A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.8 FIELD CONDITIONS
A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.

E. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Carboline Company; a subsidiary of RPM International.
   b. GCP Applied Technologies Inc. (formerly Grace Construction Products).
   c. Isolatek International.
   d. Pyrok, Inc.

2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
4. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
7. 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: 10 or less.
   b. Smoke-Developed Index: 10 or less.

8. Compressive Strength: Minimum 10 lbf/sq. in. according to ASTM E 761.
10. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
11. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
12. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
13. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
14. Finish: As selected by Architect from manufacturer's standard finishes.
   a. Color: As selected by Architect from manufacturer's full range.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
   1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

   1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
   2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that concrete work on steel deck is complete before beginning fireproofing work.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning fireproofing work.

D. Conduct tests according to fireproofing manufacturer’s written instructions to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistant products after application.
3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:
   1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
   2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

K. Cure fireproofing according to fireproofing manufacturer's written instructions.

L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
M. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials."

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100
SECTION 07 82 50 – FABRIC DRAFT CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the fabric draft curtains.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Product Certificates: For each type of fabric draft curtain, signed by product manufacturer.
C. Research/Evaluation Reports: For fabric draft curtain.
D. Shop drawings indicating layout and details.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fabric draft curtain materials through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide fabric draft curtain with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

5. Large Scale Test: NFPA #701.
6. Fire-resistance-rated assemblies are indicated by design designations from UL’s "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

C. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to fabric draft curtains including, but not limited to, the following:

1. Review structural load limitations.
2. Review and finalize construction schedule and verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.

1.4 COORDINATION
A. Coordinate installation of fabric draft curtains with other construction specified in other Sections to comply with the following:

1. Avoid unnecessary exposure of fabric draft curtains to abrasion and other damage likely to occur during construction operations subsequent to its application.
2. Do not install fabric draft curtains on structural members until piping and other construction behind fire-resistive materials have been completed, uninterrupted coverage of fire-resistant materials can be provided, and the need for subsequent cutting and patching of fire-resistant materials has been eliminated.
3. Expedite installation of fabric draft curtains to minimize the time structural members are exposed without fire-resistant materials.
4. Do not install enclosing or concealing construction until after fabric draft curtains has been applied and inspected by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Fabri-Lock.
2. CT Industries Ltd.
4. Smoke Guard, Inc.

2.2 MATERIALS

A. Fabric shall be woven as follows: (Basis of Design: Fabri-Lock):

1. Style: 7721 or equal.
4. Fabric Construction: Warp (MD Yarns) 58 +/-2 ends/in ECDE 75 1/0 Fill (XMD yarns) 42 +/-2 picks/in ECDE 75 1/0
7. Weight: Uncoated – 8.0 +/-0.3 OSY, Coated – 9.5 +/-0.7 OSY.
8. Air Permeability: 1 cfm maximum.

B. Thread used in hemming the fabric shall be woven from the same materials as the fabric.

C. Tape shall be manufactured, using a slightly lighter weight fabric, with a heat resistant adhesive that will not penetrate the fabric. The tape fabric shall be the same color as the fabric with the same coating and testing results.
D. Frame shall be constructed of ½ inch electrical metallic tubing. Tubing shall be continuous at the top and bottom of the curtain board with verticals at 10 foot intervals to stabilize the curtain board and hold the fabric taut. The frame shall be connected with set screw tees and painted white to match the fabric draft curtain.

E. Fasteners used to support the curtain board shall be fabricated from tempered spring steel. Fasteners shall be driven onto the supporting structure and have steel teeth that dig into the member. Fasteners shall be located at 24 inch o.c maximum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Installer, prior to installation, shall receive confirmation from the General Contractor that the walls and ceilings have been painted and the floors have been sealed and/or cleaned. Installer shall be scheduled prior to fixtures and shelving being installed. This subcontractor shall report any adverse conditions to the General Contractor in writing with a copy to the Owner.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for particular conditions of installation in each case.

B. Install fabric draft curtains to comply with requirements for thicknesses, number of courses (layers), construction of joints and corners, and anchorage methods applicable to fire-resistance-rated assemblies indicated. Install in continuous piece for entire length of curtain.

C. Fabric draft curtains shall be located in accordance with the drawings and approved shop drawings. Fabric draft curtains shall be installed true and plumb at parallel and perpendicular lines to the building walls.

3.3 PROTECTION

A. Coordinate installation of fabric draft curtains with other construction to minimize cutting into, or removal of, installed fire-resistive materials. As other construction is successively completed, replace or repair fabric that has been cut away to facilitate this other construction. Maintain complete coverage of full thickness on members and substrates protected by fabric draft curtains. Keep paint off the fabric draft curtain.

B. Provide final protection and maintain conditions in a manner acceptable to Installer, manufacturer, and authorities having jurisdiction that ensure that fabric draft curtains is without damage or deterioration at time of Substantial Completion.
3.4 FINISH

A. EMT tubing shall be galvanized steel. All verticals, tees and connectors shall be painted to match the fabric color.

END OF SECTION 07 82 50
SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.

C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.
1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer’s written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL’s "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
   1. Manufacturers: Subject to compliance with requirements, 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:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. NUCO Inc.
      d. Specified Technologies, Inc.
      e. Thermafiber, Inc.; an Owens Corning company.
      f. Tremco, Inc.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. Specified Technologies, Inc.
      d. Thermafiber, Inc.; an Owens Corning company.
      e. Tremco, Inc.
   2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
   1. Sealant shall have a VOC content of 250 g/L or less.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, 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: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications as accepted in shop drawing submittal.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistant joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Government will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 07 84 43
SECTION 07 91 00 - PREFORMED JOINT SEALS

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. Precured, extruded-silicone joint seals.

1.3 ACTION SUBMITTALS

A. Product Data: For each preformed joint seal product.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.

C. Preformed Joint Seal Schedule: Include the following information:
1. Joint seal location and designation.
2. Joint width and movement capability.
3. Joint seal manufacturer and product name.
4. Joint seal color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each preformed joint seal for tests performed by a qualified testing agency.

B. Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Mockups: Install mockups of assemblies specified in other Sections that are indicated to receive preformed joint seals specified in this Section. Use materials and installation methods specified in this Section.
1.6 WARRANTY

A. Special Warranty: Installer agrees to repair or replace preformed joint seals 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 preformed joint seals to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXTRUDED-SILICONE JOINT SEALS

A. Extruded-Silicone Joint Seals: Manufacturer's standard seal consisting of precured low-modulus silicone extrusion, with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties; Model VF-200 or comparable product by one of the following:

   a. Dow Corning Corporation.
   b. Sealex, Inc.
   c. Sika Corporation; Joint Sealants.
   d. Tremco Incorporated.

2. Joint Seal Width: Joint size indicated on Drawings plus 1 inch.
3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to preformed joint seal manufacturer, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces, and formulated to promote best adhesion to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with preformed joint seals and surfaces adjacent to joints.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal 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 optimal bond with preformed joint seals. 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.

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 seals. Nonporous joint substrates include the following:
   a. Metal.

B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.
3.3 INSTALLATION

A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Installation of Precured, Extruded-Silicone Joint Seals:

1. Apply masking tape to each side of joint, outside of area to be covered by seal system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone seal system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact with substrate.
4. Complete installation of seal system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

3.4 PROTECTION

A. Protect preformed joint seals from damage resulting from construction operations or other causes so seals 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 seals immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 91 00
SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

F. Field-Adhesion Test Reports: For each sealant application tested.

G. Warranties: Sample of special warranties.

H. Test results shall be a required submittal to the Government.

I. Contractor shall submit qualifications or required Independent Testing and Inspection Agent in advance of Government approval.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Schedule installation of firestopping after completion of work involving penetrating items, but prior to covering, concealing, and eliminating access to penetrations.

C. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

D. Provide joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

E. Product Testing: Test joint sealants using a qualified testing agency.

   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

A. 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. Apply elastomeric sealants to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
1. For masonry control joints, indicate all components of the building including custom color sealants to be applied to the masonry mockup panel for approval of all materials concurrently.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, 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 application indicated below:
   a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

   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 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials. Verify material is within its shelf life duration prior to usage.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
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.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates. Comply with manufacturer's surface preparation techniques prior to application.

1.9 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Dow Corning
2. Pecora Corporation
3. Sika Corporation
4. Sonneborne
5. Tremco

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Colors of Exposed Joint Sealants: As selected from manufacturer's full range.
2.3 JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920.

1. Medium Modulus Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, M, and O, with the additional capability to withstand 50 percent movement in both extension and compression for a total of 100 percent movement. Use for building expansion joints.

2. Low Modulus Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, M, and O, with the additional capability to withstand 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement. Use for building expansion joints.

3. Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. For general exterior use on vertical surfaces.

4. Single-component, nonsag urethane sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. Use for exterior traffic-bearing joints, where the slope is above 6 degrees or precludes the use of pourable sealant.

5. Single-component, pourable urethane sealant, Type S; Grade P; Class 25; Uses T, M, G, A, and O. Use for exterior traffic-bearing joints.

6. Single-component, mildew-resistant silicone sealant, Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide. Use for interior sealant joints in ceramic tile, stone, and other hard surfaces in kitchens and toilet rooms and around plumbing fixtures.

7. Medium-modulus, neutral curing silicone sealant, Type S; Grade NS; Class 25; Uses NT, G, A, and O. Use O joint substrates: coated glass, color anodic aluminum, aluminum coated with a high performance coating, galvanized steel, ceramic tile, and wood. Use at joints between aluminum storefront or curtain wall framing and adjacent substrates, joints between butt-glazed glass panels.

B. Solvent-Release Sealants: Butyl-Rubber-Based Solvent-Release Joint Sealant: ASTM C 1085. For use under all sill plates, metal flashing, gutter, roof, and other general applications.

C. Latex Sealant: Single-component, nonsag, mildew-resistant, paintable, acrylic-emulsion sealant complying with ASTM C 834. For interior use only at perimeters of door and window frames.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin); Type B (bicellular material with a surface skin); or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, 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. 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.
   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 of joint length for each kind of sealant and joint substrate.
   b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00
SECTION 07 95 13.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

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 interior expansion joint cover assemblies.

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 expansion joint cover assemblies.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

D. Samples for Initial Selection: For each type of exposed finish.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric-seal material.

E. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.
1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
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.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E 1966 by a qualified testing agency.

1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

C. Expansion Joint Design Criteria:

1. Type of Movement: Thermal and Wind sway.
   a. Nominal Joint Width: 2 inches.
   b. Minimum Joint Width: 1 inch.
   c. Maximum Joint Width: 3 inches.
2.3 WALL EXPANSION JOINT COVERS

A. Elastomeric-Seal Wall Joint Cover: Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Basis-of-Design Product: Construction Specialties, Inc.; Model SF-200, provide product indicated or a comparable product by one of the following:
   a. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
   b. Balco, Inc.
   c. BASF Corp. - Watson Bowman Acme Corp.

2. Application: Wall to corner.

3. Fire-Resistance Rating: Not less than that of adjacent construction.

4. Exposed Metal:
   a. Aluminum: Color anodic, Class II.
      1) Color: As selected by Architect from full range of industry colors and color densities.

5. Seal: Preformed elastomeric membranes or extrusions.
   a. Color: As selected by Architect from manufacturer's full range.

B. Elastomeric-Seal Wall Joint Cover: Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Basis-of-Design Product: Construction Specialties, Inc.; Model FWSC-200, provide product indicated or a comparable product by one of the following:
   a. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
   b. Balco, Inc.
   c. BASF Corp. - Watson Bowman Acme Corp.

2. Application: Wall to corner.

3. Fire-Resistance Rating: Not less than that of adjacent construction.

4. Exposed Metal:
   a. Aluminum: Color anodic, Class II.
      1) Color: As selected by Architect from full range of industry colors and color densities.

5. Seal: Preformed elastomeric membranes or extrusions.
a. Color: As selected by Architect from manufacturer's full range.

2.4 CEILING EXPANSION JOINT COVERS

A. Elastomeric-Seal Ceiling Joint Cover: Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Basis-of-Design Product: Construction Specialties, Inc.; Model HCW-200, provide product indicated or a comparable product by one of the following:

   a. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
   b. Balco, Inc.
   c. BASF Corp. - Watson Bowman Acme Corp.

2. Application: Wall to ceiling.

   a. Aluminum: Color anodic, Class II.

      1) Color: As selected by Architect from full range of industry colors and color densities.

3. Seal: Preformed elastomeric membranes or extrusions.

   a. Color: As selected by Architect from manufacturer's full range.

2.5 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.

   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304 for plates, sheet, and strips.

C. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

E. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.
F. 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.

2.6 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.7 ACCESSORIES

A. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

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

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.

2. Install frames in continuous contact with adjacent surfaces.
   a. Shimming is not permitted.

3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.

5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.

6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

   1. Provide in continuous lengths for straight sections.
   2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
   3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.

   1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 13.13
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 exterior building expansion joint cover assemblies.

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 expansion joint cover assemblies.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each exposed expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

D. Samples for Initial Selection: For each type of exposed finish.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

E. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.
1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
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.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Expansion Joint Design Criteria:

1. Type of Movement: Thermal and Wind sway.
   a. Nominal Joint Width: 2 inches.
   b. Minimum Joint Width: 1 inch.
   c. Maximum Joint Width: 3 inches.

2.3 EXTERIOR EXPANSION JOINT COVERS

A. Exterior Metal-Plate Joint Cover: Assembly consisting of sliding metal cover plate in continuous contact with gaskets mounted on metal frames fixed to sides of joint gap.

1. Basis-of-Design Product: Construction Specialties; Model RJTW-200, provide product indicated or a comparable product by one of the following:
2. Application: Wall to wall.

3. Installation: Surface mounted.

4. Exposed Metal:
   a. Aluminum: Manufacturer's standard.
      1) Color: As selected by Architect from full range of industry colors and color densities.

2.4 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304 for plates, sheet, and strips.

C. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

E. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.5 ALUMINUM FINISHES

A. Mill finish.

B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

2.6 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
   1. Provide where indicated on Drawings.
B. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

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

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.

3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.

4. Install frames in continuous contact with adjacent surfaces.

   a. Shimming is not permitted.

5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections.

END OF SECTION 07 95 13.16
SECTION 08 04 00 – BLAST RESISTANCE

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Refer to the specific technical specifications sections for additional information regarding the following: Cold-Formed Metal Framing, Doors, Glazing, Curtain Walls, Store Front, Windows, Equipment, Pumps, Chillers, Fans, Air Handling Units, Motor Control Centers, and Distribution Panels.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A500/A500M (2013) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes


### References

<table>
<thead>
<tr>
<th>Standard/Report</th>
<th>Edition</th>
<th>Description</th>
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<tr>
<td>ASTM F2912</td>
<td>(2011)</td>
<td>Standard Test Method for Metal Doors Used in Blast Resistant Applications (Equivalent Static Method)</td>
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</table>

### American Society of Civil Engineers

- **ASCE 59-11** (2011) Blast Protection of Buildings

### United Facilities Criteria

- **UFC 4-010-01** (2013) DoD Minimum Antiterrorism Standards for Buildings

### Protective Design Center Technical Report

- **PDC-TR 10-02** (2012) Blast Resistant Design Methodology for Window Systems Designed Statically and Dynamically

### General Response Criteria

- **A.** General response criteria listed as per the publications listed in the References section.
- **B.** Building Level of Protection
1. The facility is designed in accordance with UFC 4-010-01 and meets the protective compliance and strategies as stated in UFC 4-010-01 and other applicable project documents.
   a) C-17 Shops and Administrative Building (Area A & B per the drawings): Primary Gathering/Low Level of Protection
   b) Simulator Building: Inhabited Building/Very Low Level of Protection
   c) C-17 Hangar Bay Building (Area C, D & E per the drawings): Low Occupancy
   d) Fire Pump House Building: Low Occupancy

C. Level of Protection Performance
   1. Glazing will fracture, remain in the frame and results in a minimal hazard consisting of glass dust and slivers (Minimal hazard rating)
   2. Doors will experience non-catastrophic failure, but will have permanent deformation and may be inoperable (Category III).

D. Mandatory Compliance References
      a) Applicable UFC 4-010-01 Standards (s): B-3.1 Standard 10. Windows & Skylights
      b) Standard 12- Exterior Doors
      c) Standard 19- Equipment Bracing

1.4 HAZARD RESISTANT GLAZING
   A. Glazing: Heat Strengthened (HS) or fully tempered. Glazing shall consist of single laminated panes, insulating glass units (IGUs) with a laminated inner pane (and outboard pane if required for design loads), glass-clad polycarbonate, or laminated plastics in compliance with UFC 4-010-01 Standard 10.

1.5 SYSTEM DESCRIPTION
   A. Blast resistant doors and window systems are scheduled on the architectural drawings. The requirements listed in this section are performance standards related to blast resistance. Where blast resistance is a design consideration, the requirements of this section shall be met in addition to all other requirements from the main product specification sections. Each door assembly shall include the door, frame, anchors, hardware, and accessories and shall be provided by a single manufacturer. Frames and anchors for doors and windows systems shall be capable of transferring blast and rebound reactions to the adjacent supporting structure. Resistance to blast shall be demonstrated either by design calculations or tests on prototype door assemblies.

1.6 ADMINISTRATIVE REQUIREMENTS
   A. Section 01: Project management and coordination procedures.
   B. Coordination:
      1. Coordinate with other work having direct bearing on work of this section.
2. Coordinate the work of this section with all sections referencing this section.

1.7 SUBMITALS FOR REVIEWS

A. Section 01: Submission procedures.

B. Shop Drawings: Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, bracing, materials, and types and thickness of glass.

C. Design Data: Submit design analysis with calculations showing that the design of each different size and type of unit and its anchorage to the structure meets the minimum performance requirements of this section, unless conformance is demonstrated by Test results. Calculations verifying the structural performance of each unit proposed for use, under the given loads, shall be prepared and signed by a registered Professional Engineer. The unit components and anchorage devices to the structure, as determined by the design analysis, shall be reflected in the shop drawings. All calculations shall be signed and sealed by a Professional Engineer and submitted for review and approval.

D. Test Reports: For blast resistant windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shocktube, shall be included in a test report, providing information in accordance with ASTM F2247, as prepared by the independent testing agency performing the test. The test results shall demonstrate the ability of each unit proposed for use to withstand the airblast loading parameters and achieve the hazard level rating in accordance with ASTM F2912 specified in paragraph "Standard Airblast Test Method". Test report is to be stamped and signed by a Professional Engineer whose qualifications meet or exceed Quality Assurance criteria and/or certified by an accredited ASTM testing laboratory.

E. Certificates:

1. Engineer's qualifications that meet or exceed Quality Assurance criteria. At a minimum, qualifications must list each project in which the Engineer performed dynamic analysis of similar systems, the effective start and end dates of performance of the analysis and a reference.

2. Steel mill reports covering the number, chemical composition and tension properties for structural quality steels shall also be submitted.

3. When blast resistance is demonstrated by calculations, a certificate stating that the system assembly provided was manufactured using the same materials, dimensions, tolerances shown in calculations. When blast resistance is demonstrated by prototype testing, a certificate stating that the stem assembly provided was manufactured using the same materials, dimensions, tolerances as the tested prototype and connections or frame anchors is required.

1.8 QUALITY ASSURANCE

A. Qualifications: If dynamic analysis is performed, engage a licensed engineer with a minimum of 5 years’ experience in blast resistant design and demonstrable experience designing blast resistant door/window systems in the past 18 months.

B. Shop Drawing Requirements: Provide drawings that indicate elevations of doors/windows, full-size sections, thickness and gages of metal, fastenings, proposed
method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, installation details, bracing, and other related items.

C. Design Data Requirements: Submit calculations to substantiate compliance with specified Performance criteria. A registered Professional Engineer must provide calculations.

1. Submit design analysis with calculations showing that the design of each different size and type of unit and its anchorage to the structure meets the requirements of paragraph "Performance Criteria" under testing or dynamic design methods.
   a) Structural Calculations
      1) Prior to performing engineering calculations, submit a description of technique(s) that shall be employed to calculate the response of the system to the defined loading.
      2) Calculation package is to include a summary sheet briefly outlining the following:
         1. Evaluation criteria
         2. Calculation assumptions
         3. Table of results by door type/location
         4. Statement of Conformance with specification requirements
      3) Calculation submittal is to be stamped and signed by a registered Professional Engineer whose qualifications meet or exceed that of the Quality Assurance section of this specification.
      4) Submit single degree of freedom or other approved dynamic analysis method calculations.
      5) Anchorage: Analyze the strength of embedded anchor assembly, as well as pull-out and reaction forces shared with the building structure. Include exact loadings to be transferred to the building structure in the analysis.
      6) Mechanical Anchors: Mechanical anchor capacities shall be developed from dynamic testing. A Code evaluation report showing testing for dynamic loading (i.e. seismic or blast) is to be submitted with calculations.
      7) Supporting Structure: Coordination of the supporting structure interaction shall be the contractors' responsibility. The contractor's engineer performing blast calculations shall coordinate loading scenarios with the cladding contractor's engineer providing the design for the exterior cladding system.

D. Test Report Requirement: Test units are required to be similar to the project units. Identical mullion shapes, glass lay-up, door distribution and anchorage system are required between test doors and project doors. Glass pane areas and mullion spans for the project doors are required to be within 10% of the test doors.

1. Test Report Package
a) Test report package is to include a summary sheet briefly outlining the following:
   1) Brief description of the test performed
   2) Table of test results by door type/location
   3) Table of comparison between test doors and project doors
   4) Statement of Conformance with ASTM F1642 with hazard ratings in accordance with ASTM F2912.
   5) In addition, test reports must include all the information required by ASTM F1642 Section 12.

b) Test report is to be stamped and signed by a registered Professional Engineer whose qualifications meet or exceed Quality Assurance criteria and/or certified by an accredited ASTM testing laboratory.

1.9 BLAST LOADING

A. The design air blast loading for both testing and analysis will be the appropriate pressure and impulse from the applicable design explosive event. Air blast loading is listed as follows:

1. C-17 Shops and Administrative Building (Area A, B & C per the drawings):
   Air blast loading shall be per UFC 4-010-01 with Explosive Weight II at 30 feet standoff distance typical.

2. Simulator Building: Air blast loading shall be per UFC 4-010-01 with Explosive Weight II at 30 feet standoff distance typical.

1.10 PERFORMANCE REQUIREMENTS

A. Door Requirements

1. All exterior doors shall meet the minimum requirements indicated below and blast loading specified.

   a) Doors:
   Provide doors that are tested to achieve the applicable performance of Category III per UFC 4-010-01, ASCE Blast-Resistant Design and in accordance with ASTM F2247 or ASTM F2927 or that are analyzed dynamically using the approach described in the following Section.
   Fasteners and anchorage methods used to attach the tested door assembly will be representative of the actual door installation. Any deviations in actual installation of the connections or the connected elements from those tested must be demonstrated by calculation to provide the required level of protection for the specific application.

   b) Dynamic Door Analysis:
   As an alternative, blast doors may be designed dynamically to demonstrate through calculations that the door shall remain in its frame.
1) Elements may be designed to experience excessive permanent deformations but shall not pose a flying projectile hazard in response to the specified blast loading.

2) The door will experience non-catastrophic failure, but will have permanent deformation and may be inoperable. The applicable performance of Category III per UFC 4-010-01, ASCE Blast-Resistant Design

3) Connections shall be designed to develop the flexural capacity of the element being connected.

B. Window Systems Requirements

1. All exterior glazed openings shall meet the minimum requirements indicated below and the specified blast loading parameters. Window systems may be designed using static or dynamic analysis, or established by testing.
   a) Glazing
      Provide glazing thickness and lay-up that are tested to performance to a Hazard Level H2 (Minimal hazard rating) per ASTM F2912 when tested in accordance with ASTM F1642. Glazing system shall meet a minimum Specification Level Z2 with the specified blast loads.
   b) Static Analysis
      Static analysis in accordance with ASTM F2248 and ASTM E1300 is permitted. Frames and their connections may be designed using LRFD procedures with load factors and strength reduction factors taken as unity.
      Fame members designed statically shall be limited to deflections not more than 1/60 of the length of the glazing supported edge, regardless of anchor spacing, when subjected to a load equal to two times the glazing resistance determined from ASTM E1300. Members shall be checked based on section properties determined from the design strength calculations under loading equal to two times the glazing resistance at yield strength of the frame material.
      Connections for window systems shall be designed for two times the load resistance of the glazing determined from ASTM E1300 when the capacity of the glazing is more than two times the specified design air blast pressure; otherwise, connections may be designed for the load resistance of the glazing determined from ASTM E1300. Connection design shall consider edge distance, spacing, embedment depth, material strength, etc. required to fully develop the connectors. Strength reduction factors shall be taken from the appropriate material codes for all connection designs.
   c) Dynamic Analysis
      Dynamic analysis using computer programs recognized by the blast design community is permitted. Glass design for blast effects shall be based on a maximum probability of glass breakage of 500 breaks per
1000. Post-failure performance of the window system shall be assessed using industry-standard computer programs or verified by blast testing in accordance with Section 10.6 of ASCE 59-11.

Connections and anchorage systems shall be designed to resist the smaller of the following two static loads:
1) The ultimate flexural resistance of the frame components;
2) The peak dynamic reactions from the frame.

Connection design shall consider edge distance, spacing, embedment depth, material strength, etc. required to fully develop the connectors. Strength reduction factors shall be taken from the appropriate material codes for all connection designs.

C. Interior Equipment Bracing
1. Interior equipment bracing shall be designed and detailed to reduce the potential for producing hazardous secondary fragments due to the specified explosive threats, consistent with the designated level of protection.
2. Interior equipment bracing
   a) Mount all overhead utilities and other fixtures weighing 31 pounds or more (excluding distributed systems such as piping networks that collectively exceed that weight) using either rigid or flexible systems to minimize the likelihood that they will fail and injure building occupants. Design all equipment mountings to resist forces of 0.5 times the equipment weight in any horizontal direction and 1.5 times the equipment weight in the downward direction. This standard does not preclude the need to design equipment mountings for forces required by other criteria such as seismic standards.

PART 2 PRODUCTS
2.1 MATERIALS
A. Metals
1. Framing members: Use extruded aluminum sections or continuous structural steel sections.
   a) Yield strength: Provide supporting references that grade of steel or aluminum used is capable of achieving calculated ductility ratio.
      1) Structural Steel:
         1. Structural tubing shall conform to ASTM A500/A500M, ASTM A1085, ASTM A501, or ASTM A618/A618M.
         2. Structural steel bars, plates and shapes shall conform to ASTM A36/A36M.
         3. Sheet steel and strip shall conform to ASTM A653/A653M.
   b) If dynamic analysis is used, the yield strength of doors, mullions and frame elements may be increased to account for strain rate effects. The
strength increase factor (SIF) and dynamic strength increase factor (DIF) per PDC-TR 06-01 may be utilized.

c) Section Modulus: The plastic section modulus may be used in dynamic design analysis.

d) Built-up Sections: Section properties of a built-up member consisting of individual components of the same or a combination of materials (i.e. steel and aluminum) shall be determined based on the following:

1) Ultimate stress and strain compatibility between individual member components shall be accounted for through industry standard methods of analysis.

2) Composite section properties may only be used if calculations demonstrate deformation full shear stress transfer along the line of contact between individual members components.

3) Combined section properties may only be used if calculations demonstrate deformation compatibility between aluminum and steel components.

e) Hardware: In the absence of a continuous door stop, hinges and other mechanical hardware shall provide a load path from the door leaf to frame/mullion and be manufactured to support the door and resist blast induced loading. Hardware is not required for resistance of rebound loading as the door leaf may fail outward away from the building.

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION 08 04 00
WINDOW SYSTEM DESIGN LOAD COMPLIANCES & ANALYSIS

Project Name: NC ANG C-17 Corrosion Control/Fuel Cell Simulation Building- FJRP159062

Building Category: C-17: Primary Gathering Building/LLOP
Simulation Building (SIM): Inhabited Building/ VLLOP

Jacobs Design Location: Arlington

Protective Design Analysis Engineer: WJM/Arlington Date: 3/16/17
Revision: WJM
QC-CK:

GENERAL

A. Protective Design Details:

UFC 4-010-01 1 Oct 2013 Standard 10. Explosive weight II (FOUO) is the controlling design basis threat to determine the window system design load resistance at the applied standoff distance as identified in the AT/FP narrative and Arch site plan at the NC ANG C-17 Hanger & Sim Building locations. The target facilities primary installation access entry and control point facilities is located within a controlled area with the demonstrated capability to authenticate, validate, and search for vehicle bombs. Both facilities are designed in accordance with UFC 4-010-01 and designated as a low level of protection (LLOP) & Very Low level of Protection (VLLOP) buildings as noted above, and meets the protective compliances and strategies as stated in UFC 4-010-01 and other applicable supporting project documents.

B. Acceptable Computer Software:

(USACE Protective - Design Center - Single Degree of Freedom Blast Effects Design [SBEDS-latest Edition] Omaha Approved Software), WINGARD PE 6 or (Latest Version), and SBEDS-W (Version 1.1.1 or latest version). Other window design load tools or software that measure the dynamic response of the window system- glass, frame, anchorage and supporting structure are acceptable only by approval by owner or owner’s representative.

Note: WINGARD PE may provide a conservative approach for the design of the window systems for the facility and may not be an economical approach. Please plan accordingly for the most effective and economical design solution.

C. Glazing Level of Protection Performance:

Glazing will fracture, remain in the frame and result in a minimal hazard consisting of glass dust and slivers.(Minimal hazard rating) Doors will stay in frames, but will not be reusable.
D. Window System Mandatory Compliance References:

1. Primary Document Compliance:

DoD Minimum Antiterrorism Standards for Buildings; Change 1, 1 October 2013 Standard 10 or latest version.

a. Applicable UFC 4-010-01 Standards (s): B-3.1 Standard 10. Windows and Skylights.
b. Standard 12- Exterior Doors- B-3.3.2 (Glazed Doors)

2. Supporting Document Compliances for NC ANG C-17 & Simulation Building:

- UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings 9 Feb 2012, Change 1, 1 Oct 2013
- UFC 4-010-02 (FOUO) DoD Minimum Standoff Distances for Buildings 9 Feb 2011
- ASTM F2248-12 (or latest version) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass.
- PDC-TR 10-01 Conventional Construction Standoff Distances of the Low and Very Low Levels of Protection IAW UFC 4-010-01
- PDC-TR 10-02 Blast Resistant Design Methodology for Window Systems Designed Statically and Dynamically 19 April 2012
- PDC-TR 06-08, Single Degree of Freedom Structural Response Limits for Antiterrorism Design, 2006
- Single degree of freedom Blast Effects Design Spreadsheet, U.S. Army Corps of Engineers Protective Design Center, 2006
- DoD Instruction 2000.16 Antiterrorism Standards, October 2, 2006
- American Society of Civil Engineers Standard (ASCE/SEI) 7-10 Minimum Design Loads for Buildings
- Air Force Instruction 10-245 Air Force Antiterrorism Standards (AT) Standards
- Air Force Instruction 31-101 Air National Guard Supplement 1 The Air Force Installation Security Program
I. HAZARD RESISTANT GLAZING-DIMENSIONS DATA

A. Glazing Information

B. Lite Dimensions: Window Reference and Architectural Window Profile: Curtainwall & Polycarbonate Opening Profile. A 606

C. Glazed Door Types: Reference Door type as noted in door schedule elevations. A-606

D. Glazing: (HS) or fully tempered. Glazing shall consist of single laminated panes, insulating glass units (IGUs) with a laminated inner pane, glass-clad polycarbonate, or laminated plastics in compliance with UFC 4-010-01 Standard 10.

II. GLASS CONSTRUCTION

Representative Sampling Basis of Design Lay-up for C-17 Hanger & Simulation Building
(Six separate sizes were analyzed to determine a balanced consistent layup)

A. Basis of Design:

Recommended glazing layups are shown in the table below with various daylight opening sizes that the layups work for in the table that follows it.

<table>
<thead>
<tr>
<th>Glass Layup</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
</tr>
<tr>
<td>IGU- Laminated: 3/8 HS outboard pane, .5 airgap, Inboard pane 1/8-0.03in PVB, 1/8 HS (1/4)</td>
</tr>
<tr>
<td>W2</td>
</tr>
<tr>
<td>IGU- Laminated: 3/8 HS outboard pane, .5 airgap, Inboard pane 1/8-0.03in PVB, 1/8 HS (1/4)</td>
</tr>
<tr>
<td>W3</td>
</tr>
<tr>
<td>IGU- Laminated: 3/8 HS outboard pane, .5 airgap, Inboard pane 1/8-0.03in PVB, 1/8 HS (1/4)</td>
</tr>
<tr>
<td>W4</td>
</tr>
<tr>
<td>IGU- Laminated: 3/8 HS outboard pane, .5 airgap, Inboard pane 1/8-0.03in PVB, 1/8 HS (1/4)</td>
</tr>
<tr>
<td>W5</td>
</tr>
<tr>
<td>IGU- Laminated: 3/8 HS outboard pane, .5 airgap, Inboard pane 1/8-0.03in PVB, 1/8 HS (1/4)</td>
</tr>
<tr>
<td>W6</td>
</tr>
<tr>
<td>IGU- Laminated: 3/8 HS outboard pane, .5 airgap, Inboard pane 1/8-0.03in PVB, 1/8 HS (1/4)</td>
</tr>
<tr>
<td>W7</td>
</tr>
<tr>
<td>IGU- Laminated: 3/8 HS outboard pane, .5 airgap, Inboard pane 1/8-0.03in PVB, 1/8 HS (1/4)</td>
</tr>
<tr>
<td>W8</td>
</tr>
<tr>
<td>IGU- Laminated: 3/8 HS outboard pane, .5 airgap, Inboard pane 1/8-0.03in PVB, 1/8 HS (1/4)</td>
</tr>
</tbody>
</table>
### B. Typical Reactions

<table>
<thead>
<tr>
<th>Peak Dynamic Reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Along Long Side = 1.86 psi</td>
</tr>
<tr>
<td>Along Short Side = 0.85 psi</td>
</tr>
</tbody>
</table>

Based on a 36 (W) X 59 (H)

### C. Definition: Plates= glass panes

<table>
<thead>
<tr>
<th>Width (Ft)</th>
<th>24</th>
<th>27</th>
<th>28</th>
<th>36</th>
<th>72</th>
<th>57</th>
<th>72</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (Ft.)</td>
<td>59</td>
<td>W6</td>
<td>W1,W8</td>
<td>W2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45.5</td>
<td>W6</td>
<td>W4,W5</td>
<td>W4</td>
<td>W4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29.5</td>
<td></td>
<td>W2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>27</td>
<td></td>
<td>W9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>W3,4,5,10,11,12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>W6</td>
<td></td>
<td></td>
<td>W4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21.5</td>
<td>W6</td>
<td>W4,W5</td>
<td>W4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Polycarbonate- W 12,
D. **Window frames** shall be aluminum. The use of other materials shall be verified through testing to meet the design basis threat loading identified in this report.

### Tables 1A & B  Summary of Fully Reflected Blast Loads at NC C-17 & Sim

<table>
<thead>
<tr>
<th>Charge Weight</th>
<th>Standoff (ft)</th>
<th>Peak Pressure</th>
<th>Peak Impulse</th>
<th>Positive Phase Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-17 EW- II (FOUO) Controlling Load</td>
<td>46.1</td>
<td>15.8</td>
<td>55.57</td>
<td>10.89</td>
</tr>
<tr>
<td>Sim Bldg EW-II (FOUO) Controlling Load</td>
<td>56.1</td>
<td>10.82</td>
<td>44.75</td>
<td>11.73</td>
</tr>
</tbody>
</table>

Summary of fully Incident Blast Load at NC C-17/Sim (Information only) as long as the applied construction distance is maintained as identified in the tables above.

<table>
<thead>
<tr>
<th>Charge Weight</th>
<th>Standoff (ft)</th>
<th>Peak Pressure</th>
<th>Peak Impulse</th>
<th>Positive Phase Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-17 WII (FOUO)</td>
<td>41.6</td>
<td>6.708</td>
<td>26</td>
<td>22.68</td>
</tr>
<tr>
<td>SIM</td>
<td>56.1</td>
<td>4.793</td>
<td>21.79</td>
<td>11.73</td>
</tr>
</tbody>
</table>

**Note:** Roof blast loading (fully incident) - Max Peak pressure loading at the edge of the roof area near the threat. The roof peak pressure & impulse (at the edge) are approximately one-half of the reflected pressure & impulse applied to the walls.

E. **Standoff Distances:**

Perimeter of the site N/S/E/W to maintain applied construction distance of 46.1 & 56.1 ft from the envelop of the C-17 Hanger & Sim Building as noted in the standoff chart.

### III. **GLAZING GEOMETRY DATA**

A. **Equivalent Triangular Load**

1. Equivalence based on Pressure/Impulse
2. Explosive Type = TNT Equivalent
3. Explosive Weight II
4. Explosive weight II is applicable within the unobstructed space
5. Ranges = Primary (Controlling Load)- (EW II @ distances noted in the table), (EW II is the controlling loading impact both facilities )
6. Validation of DBT loads were defined at the various distances with Explosive Weight II.

B. **Design Load Details:** (typical)

Equivalent 3 Second Design Load: Psf to be calculated by the Contractor based on applicable standoff distances noted in this summary and project design documents.
Approximate Max. Air Blast Pressure Explosive Weight I (Reflected Pressure). Incident pressure as determined in Table B in this report.

1. **Static Design:**

   Probability of Failure- 1  
   Max Design Stress- 110316.1 kPa

2. **Dynamic Design:**

   Probability of Failure- 500 Breaks per 1000 (ASCE 59-11)  
   Max Design Stress- 170420.8 kPa

   Dead Load: Glazing= 8.0 psf  System= 12.0 psf  
   Wind Load (Punched Opening) per ASCE 7-10  
   Interior: per IBC (Current Edition)

**Material Properties:**

**Aluminum**- All aluminum framing, mullions, other framing components are assumed to be 6063 –T6 alloy. Yield and Ultimate Strength are taken as the typical Mechanical Properties provided in the Aluminum Design Manual.

   Modulus of Elasticity- 10,000,000 psi  
   Yield in Tension- 31,000 psi  
   Ultimate Strength in Tension 35,000 psi  
   Allowable Bending Stress: 15,000 psi

**Steel**: Ultimate Strength

3. **Deflection Criteria:**

   Wind Load: L/175  
   Blast Load L/160  
   Dead Load: 1/8 inch  
   Dynamic Load Rotation: 3 degree

4. **Fenestration:**

   Blast-mitigating window systems shall be designed using static or dynamic analysis in accordance with Standard 10. It shall be permitted for window design to use static analysis in accordance with ASTM F2248 and ASTM E1300 for determining the glazing capacity for a medium level of protection.
Static Increase Factors (SIF) & Dynamic Increase Factors (DIF)

<table>
<thead>
<tr>
<th>Material</th>
<th>ASTM</th>
<th>SIF</th>
<th>DIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>6063-T5</td>
<td>1.16</td>
<td>1.02</td>
</tr>
<tr>
<td>Aluminum</td>
<td>6063-T6</td>
<td>1.12</td>
<td>1.02</td>
</tr>
<tr>
<td>Cold Formed Steel</td>
<td>30-50ksi</td>
<td>1.21</td>
<td>1.10</td>
</tr>
<tr>
<td>Structural steel</td>
<td>A36</td>
<td>1.1</td>
<td>1.29</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>A572 Grade 50</td>
<td>1.05</td>
<td>1.19</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>A500 Grade B</td>
<td>1.05</td>
<td>1.19</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>A500 Grade C</td>
<td>1.05</td>
<td>1.19</td>
</tr>
<tr>
<td>Steel Reinforcing</td>
<td>A615 Grade 60</td>
<td>1.1</td>
<td>1.17</td>
</tr>
<tr>
<td>Steel Reinforcing</td>
<td>WWF A 185</td>
<td>1.00</td>
<td>1.12</td>
</tr>
<tr>
<td>Concrete</td>
<td>$f_c$</td>
<td>1.1</td>
<td>1.19</td>
</tr>
</tbody>
</table>

### Window SDOF Properties for P-i Analysis*

<table>
<thead>
<tr>
<th>Property</th>
<th>Inner/Single</th>
<th>Outer</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass, $M$</td>
<td>228.1</td>
<td>228.1</td>
<td>psi-ms²/in</td>
</tr>
<tr>
<td>Stiffness, $K$</td>
<td>$K_1$ 0.76</td>
<td>0.76</td>
<td>psi/in</td>
</tr>
<tr>
<td></td>
<td>$K_2$ 0.28</td>
<td>0.28</td>
<td>psi/in</td>
</tr>
<tr>
<td></td>
<td>$K_3$ 0.00</td>
<td>0.00</td>
<td>psi/in</td>
</tr>
<tr>
<td></td>
<td>$K_4$ 0.00</td>
<td>0.00</td>
<td>psi/in</td>
</tr>
<tr>
<td></td>
<td>$K_5$ 0.00</td>
<td>0.00</td>
<td>psi/in</td>
</tr>
<tr>
<td>Resistance, $R$</td>
<td>$R_1$ 1.73</td>
<td>-1.73</td>
<td>psi</td>
</tr>
<tr>
<td></td>
<td>$R_2$ 2.14</td>
<td>-2.14</td>
<td>psi</td>
</tr>
<tr>
<td></td>
<td>$R_3$ 2.14</td>
<td>-2.14</td>
<td>psi</td>
</tr>
<tr>
<td></td>
<td>$R_4$ 2.14</td>
<td>-2.14</td>
<td>psi</td>
</tr>
</tbody>
</table>

### IV. TYPICAL WINDOW LAYUP (THIS REPORT IS A CONCEPTUAL REPRESENTATION ONLY)

**Note:** The Contractor is responsible for calculating the FINAL window design loads and developed layups for each opening to meet their specific design approach using either the static (3-Sec Equiv) or dynamic method in compliance with UFC 4-010-01 Standard 10. A dynamic response analysis is encouraged. The calculations in this report are A Basis of Design only and not to be considered as FINAL.

### V. EXTERIOR SINGLE & DOUBLE GLASS DOORS

Glazing in Door-(glazing aligned with glass construction noted in this report). Surrounding frame connections do not need to meet Standard 10 compliance as long as they cannot be propelled into an inhabited space from an explosion event.

1. UFC design criteria for windows, glazed doorframe members, hardware, and connections must be designed per ASTM E 1300 and ASTM F 2248. The deflection cannot exceed L/160.
2. UFC design criteria for windows, glazed door glass must be designed per ASTM E 1300 and ASTM F 2248.
3. UFC design criteria for windows, glazed doorframe, connections to structural substrate system must be designed per ASTM E 1300 and ASTM F 2248.

a. Exterior Glass Door Requirements (Door Type)

Standard 12- B-3.3.2 Glazed Doors: Glazing in glazed doors must meet the glazing and frame bite provisions of Standard 10- which reads: Refer to ASTM F 2248 for glazing frame bite requirements for structurally or non- structurally glazed windows. For structurally glazed applications, apply the structural silicone bead to both sides of the glass panel-for single pane glazing but only to the inboard side for IGU. Standard 12-paragrap B-3.3.3, Alternative Designs, states” As an alternative to the above provisions for all doors, position doors such that they will not be propelled into rooms if they fail in response to a blast or provide other means to ensure they do not become hazards to building occupants. Glass door/frame connection requirements- See ASTM F2248-12 compliance listed below.

Vestibules: C-17 H 101, 102 & Sim Building: S 101 & 102. The inner doors such as sidelights and transoms must meet the provisions of UFC 4-010-01 B-3.3.4.

VI. WINDOW DESIGN LOAD PRACTICE COMPLIANCE DEFINITION

UFC Standard 10 provides a combination of prescriptive and performance based criteria that are appropriate as long as the building meets at least the minimum standoff distances defined in the UFC Standard 1 and as identified in this report. Window, frames, mullions, and sashes of aluminum or steel must be designed using the allowable stress method and the equivalent 3-second duration load listed in the ASTM F 2248-12, which has charts that provide equivalent static blast loads based on explosive weight and standoff distances. This Practice requires the equivalent 3-second duration load to be calculated using the lesser of the actual standoff distance, or “conventional construction” standoff distance (Explosive weight I @ specified ft. identified in this report) The window system shall be designed so that the primary member (in this case the glazing panel) will not fail at the supporting elements and their connections. In developing a static approach; the window frames and their connections to the supporting structure shall be designed to twice the resistance of the glass. Therefore, the window system construction and serviceability design requirements are per ASTM F2248 and UFC 4-010-01, using an equivalent static load defined herein as not less than two times the glazing resistance of the glass calculated per ASTM E1300. Supporting elements to which the window systems are attached shall be designed per the requirements of UFC 4-010-01.

The Contractor must ensure that connections provide ductile failure mechanisms and is capable of providing the required design strength for the max end rotations calculated for supported structural members.

A. Dynamic Analysis/Design Approach

A dynamic nonlinear approach is encouraged, and more likely to provide a design that meets the design constraints of the project than a static approach. The static calculations identified in this analysis are likely to provide a conservative design solution especially when the peak pressure is
considered without the effect of load duration. The dynamic approach considers the very short duration of the loading, and the inertial effect that greatly improves response that may provide for a more balanced, economical, and constructible design in the overall window system.

B. ASTM F 2248 Compliance Standards (Silicone Sealant):

The practice assumes that blast resistant glazing shall be adhered to its supporting frame using structural silicone sealant or adhesive glazing tape. The width of the structural silicone sealant bead shall be at least equal to but not larger than two the thickness designation of the glass to which it adheres. The width of the glazing tape shall be at least equal to two times but not more than four times the thickness designation of the glass to which it adheres.

C. Contractor Responsibilities for Window System Design and Supporting Calculations & Analysis:

Design Submittals will include the following elements at a minimum. Narrative of how each (applicable) standard under UFC 4-010-01 has been met, and to include:

1. Applicable explosive weight (DO NOT LIST ACTUAL EXPLOSIVE WEIGHT IN YOUR DOCUMENTS) identify as EW-II and level of protection.
2. Identify applicable standoff distances.
3. Provide complete validation, verification of all rectangular window opening sizes (HXW) for this project as listed in the Architectural Drawings.
4. Design Build Contractor is responsible for the completed FINAL design, fabrication and installation of the window system to meet the design basis threat load against the specified compliance standards identified in this summary.
5. Provide Blast resistant window system and supporting structure calculations with window system test results to meet ASTM 1642-04.
6. Provide a Statement of Compliance that clearly indicates that the window system design & analysis meet all applicable performance compliances as noted in this report and that it safely carries the calculated DBT loads without failure.
7. Although we do not recommend: Provide structural building element analysis or design calculations where standoff distances of less than the applicable conventional construction standoff distance are provided. (if applicable).
8. Show Connections to the exterior façade to carry the DBT loads. The connections include:
   - The connection between the window glass and the window mullion transom or frame.
   - The connection between the window frame and the wall.
   - The connection between the wall and the structural frame; including the Jamb mullion to supporting structural element.

D. Window System Full Scale Mock-up

The mock-up shall be in accordance with the primary glazing specification, requirements prior to installation, and shall include all exterior glass types. General performance for Heat Strengthened and flat glass shall be in accordance with ASTM C-1048-04 & ASTM C 1036. Contractor shall ensure that all glazed products do not distortion i.e., roll ripple, bow or warped (positive or negative) in the fabricated glass product. The NC-ANG or its representative shall inspect the delivered product with the contractor to ensure the complete window system mock-up meets the...
Acceptability requirements and compliances prior to installation. In addition ensure the following:

- Production of all heat-treated glass for this project was fabricated on the same equipment, using the same processing parameters.
- Heat-treated glass roller wave must not exceed a tolerance of 0.005 inches.
- Glass distortion may also occur due to strain patterns in heat-treated glass or interference fringe patterns in the fabrication of insulating glass units.
- Thicker glass is less prone to distortion.
- Orient heat-treated glass so that roller wave (the periodic wave imparted to glass during heat-treatment, measured by the peak-to-valley distance) is parallel to the window sill/header.

**Heat Strengthened Glass (HS):** Tempered and HS quality standards for various sizes and thicknesses shall comply with ASTM C-1048/12e1 Standard for Heat Strengthened & Fully Tempered Flat Glass. Contractor shall ensure that the finished glazing product is free of Roll Ripple during the HS fabrication process and that the glazed panels are not bowed or warped (either positive or negative). There will be no optical image distortion permitted in exterior vision glass.

**E. Frame & Framing Attachment Requirements:**

1. **Performance:** The window frame shall fully retain the glazing of the design blast loading.
2. The blast resistance design requires wet glazing in frame with a 3/8 inch square bead. (Dow 995 or Equivalent) or equivalent product recommended by the glazing system manufacturer.
3. The ASTM F2248-12 (or latest version) Practice Standards assume the framing system supporting the blast resistant glazing shall attach mechanically to the structural framing system with fasteners that will resist forces generated by a uniform load acting on the blast resistant glazing that has a magnitude at least 2.0 times the magnitude of the 3-second equivalent design load as determined per the requirements listed above. (Dependent on methodology of the analysis)
4. Testing in accordance with ASTM F2248-12 (or latest version) ASTM 1642. Testing” or proven by analysis to demonstrate performance equivalent to or better than the hazard rating associated with the applicable Medium level of protection.

**F. Mullions (If Applicable for Design)**

Provide Mullions in accordance with ASTM F2248-12 (or latest version). The contractor shall consider the applied load instead of a static approach and consider the peak pressure and impulse values when design of the vertical frame members connecting the adjoining windows. A static approach may be overly conservative in this application, and may drive up weight and costs of the window system.

**Performance:**

- Frames and mullions shall be designed to prevent two modes of failure: (1) detachment of elements from the supporting system, and (2) large deformation that leads to premature failure of the glazing.
• Rotation: All structural members are required to have a rotation of 3 degrees or less
• Ductility: All structural members are required to have a ductility of 6 or less.
• Steel bars/shapes used to reinforce aluminum extrusions shall be fully captured in the frame in tight bearing or calculations shall be provided showing adequate internal connections are provided to transfer the blast loads across the interface between the members.
• Snap on elements or other deformation sensitive members and connections shall not be considered in determining the structural capacity of the mullion unless blast testing is available demonstrating the components will remain attached at the response predicted.
• For dynamic analysis, frames and mullions shall resist the glazing capacity based on a minimum probability of glass breakage equal to 500 breaks per 1,000 where balanced design is required, unless a lower statistical value can be justified.

G. Anchorage & Connection Design:

The design of the anchorage into the supporting structural element uses the static or dynamic shears as well as the pressure loads corresponding to the maximum capacity of the glazing. The window system contractor and manufacturer shall ensure that the anchor type(s) utilized in the design are best suited to meet the integrity of the window system design and connection load compliance requirements within the supporting element configurations shown in the Contract Documents. The number, size and spacing of the anchors shall consider shear, pullout, bending, and combined loading. Ultimate failure strength of the materials may be used in the anchorage & connection design. A minimum factor of safety of 1.65 shall be maintained. Designs based upon manufacturer supplied data may use the published “ultimate capacity” values with the minimum factor of safety of 1.65 still applying.

VII. STATEMENT OF COMPLIANCE (CONTRACTORS ACKNOWLEDGMENT):

Procedures to determine the static load resistance for all window glass identified in this report are in accordance with ASTM E1300-09a. The design of the window systems must satisfy ASTM F1642 requirements for minimal hazard, and satisfy the requirements for a medium level of protection as defined in UFC 4-010-01 Standard 10.

A. ASTM F1642-04 Compliance

The Contractor shall provide documented proof to the OWNER or OWNERS REPRESENTATIVE that glazing was tested in accordance with ASTM F1642-04 compliances under the design loading.

The Contractor must Ensure: The blast resistant glazing design is developed with laminated glass subject to the following conditions.

• The glass is free of edge and surface damage.
• The blast resistant glazing assembly is continuously supported along all four edges by framing elements of the window system. The framing elements of the window system shall be designed to deliver the design loads specified herein to support framing locations indicated on the Contract Documents.
- The stiffness of members supporting any glass edge shall be sufficient that under an equivalent 3 second design load, edge deflections of glazing shall not exceed L/160, where L denotes that length of the supported edge.

- The non-factored load values for laminated glass are representative of test data and calculations performed for polyvinyl butyral interlayer at a temperature of 50 degrees C (122 degrees F). For other limiting conditions that may apply, refer to section 5 of ASTM E1300 and local building codes.

END OF ATTACHMENT
SECTION 08 05 00 - COMMON WORK RESULTS FOR OPENINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes AT/FP for windows, doors, and glazing specified in Division 08.

B. Refer to report at end of this document:


PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 08 05 00
SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:
   1. Section 08 04 00 "Blast Resistance" for door and frame protection requirements.
   2. Section 08 05 00 "Common Work Results for Openings" for AT/FP analysis and door frame connection requirements.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

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. 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.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 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- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Mesker Door Inc.
4. Republic Doors and Frames.
5. Steelcraft; an Allegion brand.
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 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.


1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.


c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.053 inch.

d. Edge Construction: Model 2, Seamless.

e. Core: Polyurethane

3. Frames:

a. Materials: Metallic-coated, steel sheet, minimum thickness of 0.053 inch.

b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.

c. Construction: Full profile welded.


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.


1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
   d. Edge Construction: Model 2, Seamless.
   e. Core: Polyurethane.

   1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than R-10 when tested according to ASTM C 1363.

3. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
   b. Construction: Full profile welded.


2.5 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 thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
   3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-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, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. 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.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

G. 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.

H. Glazing: Comply with requirements in Section 088000 "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 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, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.

2. Fire Door Cores: As required to provide fire-protection ratings indicated.


4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors 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 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. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
   b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Four anchors per jamb from 60 to 90 inches high.
   c. Compression Type: Not less than two anchors in each frame.
   d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive 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.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch 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.

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, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, 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 plus or minus 1/32 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
   c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
   d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13
SECTION 08 12 16 - ALUMINUM 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:
      1. Fire-rated interior aluminum doors and frames.

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, fire-resistance rating, and finishes.
   B. Sustainable Design Submittals:
      1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   C. Shop Drawings: For aluminum frames:
      1. Include elevations, sections, and installation details for each wall-opening condition.
      2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
      3. Include locations of reinforcements and preparations for hardware.
      4. Include details of anchorages, joints, field splices, connections, and accessories.
      5. Include details of moldings, removable stops, and glazing.
   D. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard sizes.
   E. Samples for Initial Selection: For each type of exposed finish.
1. Include Samples of seals, gaskets, and accessories involving color selection.

F. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Technical Glass Products; Fireframes Aluminum Series (60 Min,) or comparable product by available manufacturers, but not limited to the following:

1. Wilson Partitions; a division of Acradia, Inc.
4. SaftiFirst, a Division of O’Keeffe’s Inc.

B. Source Limitations: Obtain aluminum frames and frame-manufacturer's doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Frames: Frames for fire-rated door 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. Frames for Smoke- and Draft-Control Assemblies: Tested according to UL 1784 and installed in compliance with NFPA 105.
   a. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg.

2.3 COMPONENTS

A. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Aluminum Framing: ASTM B 221, with alloy and temper required to suit structural and finish requirements, and not less than 0.062 inch thick.
C. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.

D. Glazing Frames: Extruded aluminum, for glass thickness.

E. Doors: Manufacturer's standard, factory-assembled, 1-3/4-inch-thick, aluminum-framed door construction.
   1. Door Operation: Swinging.
   2. Stiles: Medium.

   1. Color: As selected by Architect from manufacturer's full range.

   1. Color: As selected by Architect from manufacturer's full range.

2.4 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals in black color.

C. Smoke Seals: Intumescent strip or fire-rated gaskets in black.

D. Glazing Gaskets: Manufacturer's standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; in black.

E. Glass: As specified in Section 08 88 13 "Fire-Resistant Glazing"

F. Door Hardware: As specified in Section 08 71 00 "Door Hardware."

2.5 FABRICATION

A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted and mitered connections.

B. Factory prepare aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 "Door Hardware."
   1. Locate hardware cutouts and reinforcements as required by fire-rated label for assembly.

ALUMINUM FRAMES 08 12 16 - 3
C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.

1. Locate removable stops on the inside of spaces accessed by keyed doors.

D. Fabricate components to allow secure installation without exposed fasteners.

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. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that wall thickness does not exceed standard tolerances allowed by throat size of indicated aluminum frame.

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

3.2 INSTALLATION

A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.

1. At fire-protection-rated openings, install fire-rated frames according to NFPA 80 and NFPA 105.

B. Install frame components in the longest possible lengths with no piece less than 48 inches; components 96 inches or shorter shall be one piece.

1. Use concealed installation clips to produce tightly fitted and aligned splices and connections.

2. Secure clips to extruded main-frame components and not to snap-in or trim members.
3. Do not leave screws or other fasteners exposed to view when installation is complete.

C. Glass: Install glass according to Section 08 88 13 "Fire-Resistant Glazing" and aluminum-frame manufacturer's written instructions.

D. Doors: Install doors aligned with frames and fitted with required hardware.

E. Door Hardware: Install according to Section 087100 "Door Hardware" and aluminum-frame manufacturer's written instructions.

3.3 ADJUSTING

A. Inspect installation, correct misalignments, and tighten loose connections.

B. Doors: Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly, and lubricate as recommended by manufacturer.

C. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and according to AAMA 609 & 610.

D. Touch Up: Repair marred frame surfaces to blend inconspicuously with adjacent unrepaired surface so touchup is not visible from a distance of 48 inches as viewed by Architect. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION 08 12 16
SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 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.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 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. Product Certificates: 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.
   3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
   4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
   5. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

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. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
      a. Provide Samples for each species of veneer and solid lumber required.
      b. Provide Samples for each color, texture, and pattern of plastic laminate required.
      c. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
   2. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS
   A. Sample Warranty: For special warranty.
   B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE
   A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
   B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 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.

1.7 FIELD CONDITIONS
   A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55] percent during remainder of construction period.

1.8 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 in a 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.


PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Graham Wood Doors; ASSA ABLOY Group company.
   4. Mohawk Flush Doors, Inc.
   5. Oshkosh Door Company.

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 WDMA I.S.1-A, "Architectural Wood Flush Doors."
   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. Regional Materials: Wood doors shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Regional Materials: Wood doors shall be manufactured within 500 miles of Project site.

D. Certified Wood: Wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.

E. Adhesives: Do not use adhesives that contain urea formaldehyde.
F. Composite Wood Products: Products shall be made without urea formaldehyde.

G. WDMA I.S.1-A Performance Grade:
   1. Heavy Duty unless otherwise indicated.
   2. Extra Heavy Duty: public toilets janitor's closets assembly spaces and exits.

H. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-1.
   2. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
   3. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
   1. Grade: Premium, with Grade A faces Custom (Grade A faces) Custom (Grade B faces).
   2. Species: Select white maple.
   5. Assembly of Veneer Leaves on Door Faces: Running match.
   6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   7. Exposed Vertical Edges: Same species as faces or a compatible species - edge Type A.
   9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
   10. Construction: Seven plies, either bonded or non-bonded construction.
   11. WDMA I.S.1-A Performance Grade: Heavy Duty.

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.
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. Transparent Finish:

   1. Grade: Premium.
   2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
   3. Staining: As selected by Architect from manufacturer's full range.

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 at heads, jambs, and between pairs of doors. Provide 1/8 inch 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 from bottom of door to top of threshold unless otherwise indicated.
   
   a. Comply with NFPA 80 for fire-rated doors.
   b. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

2. Bevel fire-rated doors 1/8 inch in 2 inches 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 08 14 16
SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acudor Products, Inc.
      b. Babcock-Davis.
      c. JL Industries, Inc.; a division of the Activar Construction Products Group.
      e. Larsens Manufacturing Company.
      f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      g. Nystrom, Inc.
   2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
   3. Locations: Wall and ceiling.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory primed.
5. Frame Material: Same material and thickness as door.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
   2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Latch and Lock Hardware:
   1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
   2. Keys: Furnish two keys per lock and key all locks alike.

E. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: 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.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING
   A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13
SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Service doors.
   2. Insulated service doors.

B. Related Requirements:
   1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.
   2. Section 099123 "Interior Painting" for finish painting of factory-primed doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. Show locations of controls, locking devices, and other accessories.
   5. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
1. Curtain slats.
2. Bottom bar with sensor edge.
3. Guides.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the following design loads:

1. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
B. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Component Importance Factor: 1.5.

2.3 DOOR ASSEMBLY

A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. McKeon Rolling Steel Door Company, Inc.
      b. Overhead Door Corporation.
      c. Raynor.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283 or DASMA 105.

D. Curtain R-Value: 6.0 deg F x h x sq. ft./Btu.

E. Door Curtain Material: Galvanized steel.

F. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.

G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from stainless steel or aluminum extrusions and finished to match door.

H. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

I. Hood: Match curtain material and finish.
   1. Shape: Round.

J. Electric Door Operator:
   1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
   2. Operator Location: Wall.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
   5. Motor Electrical Characteristics:
a. Horsepower: 1 hp.
b. Voltage: 208-V ac, three phase, 60 Hz.

7. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
   a. Sensor Edge Bulb Color: Black.

8. Control Station(s): Interior mounted.

K. Door Finish:
   1. Factory Prime Finish: Manufacturer's standard color.

2.4 MATERIALS, GENERAL
   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.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION
   A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
      1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
      2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
   B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.6 HOODS
   A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.7 CURTAIN ACCESSORIES

A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.8 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.
1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Motors: Reversible-type motor for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
   a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.


I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.

2.10 GENERAL FINISH REQUIREMENTS
A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STEEL AND GALVANIZED-STEEL FINISHES
A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
B. Examine locations of electrical connections.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.
D. Power-Operated Doors: Install according to UL 325.
3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   1. Perform maintenance, including emergency callback service, during normal working hours.
   2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23
SECTION 08 34 73.13 - METAL SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes metal sound control door assemblies.

1.2 COORDINATION
   A. Coordinate installation of anchorages for sound control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages. Deliver sleeves, inserts, anchor bolts, and items with integral anchors to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.
      1. Review procedures for coordinating frame and anchor installation with wall construction.
      2. Review required field quality-control procedures.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product. Include sound ratings, construction details, material descriptions, core descriptions, and finishes.

   B. Shop Drawings: For sound control door assemblies.
      1. Include elevations of each door design.
      2. Include details of sound control seals, door bottoms, and thresholds.
      3. Include details of doors, including vertical- and horizontal-edge details and metal thicknesses.
      4. Include frame details for each frame type, including dimensioned profiles and metal thicknesses.
      5. Include locations of reinforcements and preparations for hardware.
      6. Include details of each different wall opening condition.
      7. Include details of anchorages, joints, field splices, and connections.
      8. Include details of accessories.
      9. Include details of conduits and preparations for power, signal, and control systems.

   C. Samples for Initial Selection: For units with factory-applied finishes.
D. Schedule: Provide a schedule of sound control door assemblies prepared using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of sound control door assembly.

C. Product Test Reports: For each sound control door assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound control door assemblies to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Avoid the use of 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 doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.
1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure to meet sound rating requirements.
   b. Faulty operation of sound seals.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sound Rating: Provide sound control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:

1. STC Rating: As indicated in the Door Schedule as calculated by ASTM E 413 when tested in an operable condition according to ASTM E 90.

2.2 STEEL SOUND CONTROL DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ambico Limited.
2. Amweld International, LLC.
3. Ceco Door; ASSA ABLOY.
4. Curries Company; ASSA ABLOY.
5. Fleming Door Products Ltd.; Assa Abloy Group Company.
7. Overly Door Company.

B. Source Limitations: Obtain steel sound control door assemblies, including doors, frames, sound control seals, hinges, thresholds, and other items essential for sound control, from single source from single manufacturer.

C. Doors: Flush-design sound control doors, thickness as required to provide STC rating, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC rating indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to NAAMM-HMMA 865.
1. Exterior Doors: Fabricate from metallic-coated steel sheet 0.052-inch nominal thickness or thicker as required to provide STC rating indicated.
2. Interior Doors: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.048-inch nominal thickness or thicker as required to achieve STC rating indicated.
3. Core: Manufacturer's standard sound control core.
4. Loose Stops for Glazed Lites in Doors: Same material as face sheets.
5. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6 inches o.c.
6. Hardware Reinforcement: Same material as face sheets.

D. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
   2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 zinc (galvanized) or A40 zinc-iron-alloy (galvannealed) coating designation.

E. Finishes:
   1. Prime Finish: 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.

2.3 SOUND CONTROL FRAMES

A. Frames: Fabricate sound control door frames with corners mitered, reinforced, and continuously welded the full depth and width of frame. Fabricate according to NAAMM-HMMA 865.
   1. Weld frames according to NAAMM-HMMA 820.
   2. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch nominal thickness or thicker as required to provide STC rating indicated.
   3. Hardware Reinforcement: Fabricate according to NAAMM-HMMA 865 of same material as face sheets.
   4. Jamb Anchors:
      a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch nominal-thickness uncoated steel unless otherwise indicated.
   5. Floor Anchors: Not less than 0.079-inch nominal-thickness metallic-coated steel, and as follows:
      a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
      b. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 zinc (galvanized) or A40 zinc-iron-alloy (galvannealed) coating designation.
3. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

C. Finishes:

1. Prime Finish: 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.

2.4 HARDWARE

A. Sound Control Door Hardware: Manufacturer's standard sound control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC rating indicated.

1. Head and Jamb Seals: One of the following:
   a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
   b. Silicone Compression Seals: One-piece units consisting of silicone compression bulb and stabilizer flange; attached to door frame adhesively.
   c. Magnetic Seals: One-piece units consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.

2. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
   a. Mounting: Mortised or semimortised into bottom of door as required by testing to achieve STC rating indicated.
3. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
4. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch when door is fully open; with hardened pin; fabricated from stainless steel.
5. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum.
   a. Finish: Clear anodic finish.

B. Other Hardware: Comply with requirements in Section 087100 "Door Hardware."

2.5 FABRICATION

A. Steel Sound Control Door Fabrication: Sound control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
   1. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
   2. Hardware Preparation: Factory prepare sound control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
      a. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
      b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

3. Tolerances: Fabricate doors to tolerances indicated in NAAMM-HMMA 865.

B. Sound Control Frame Fabrication: Fabricate sound control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. 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.
   1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   4. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
1) Three anchors per jamb up to 60 inches in height.
2) Four anchors per jamb from 60 to 90 inches in height.
3) Five anchors per jamb from 90 to 96 inches in height.
4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches, or fraction thereof, more than 96 inches in height.
5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

5. Hardware Preparation: Factory prepare sound control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
   a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
   b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

6. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 865.

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.

B. 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. Prior to installation, adjust and securely brace sound control door frames to the following tolerances:

   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.
3.3 INSTALLATION

A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

B. Frames: Install sound control door frames in sizes and profiles indicated.

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. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
   b. Remove temporary braces only after frames or bucks have been properly set and secured.
   c. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.


4. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

5. Installation Tolerances: Adjust sound control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Doors: Fit sound control doors accurately in frames, within clearances indicated below. Shim as necessary.

1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with tolerances indicated in NAAMM-HMMA 865.

D. Sound Control Seals: Where seals have been factory prefit and preinstalled and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.

E. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.

F. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 "Joint Sealants."
3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Perform testing for verification that assembly complies with STC rating requirements.

1. Acoustical testing and inspecting agency shall select one sound control door(s) at random from sound control door assemblies that are completely installed for testing.

2. Field tests shall be conducted according to ASTM E 336, with results calculated according to ASTM E 413. Acceptable field NIC values shall be within 5 dB of laboratory STC values.

3. Inspection Report: Acoustical testing agency shall submit report in writing to Architect and Contractor within 24 hours after testing.

4. If tested door fails, replace or rework all sound control door assemblies to bring them into compliance at Contractor's expense.

   a. Additional testing and inspecting at Contractor's expense will be performed to determine if replaced or additional work complies with specified requirements.

C. Prepare test and inspection reports.

3.5 ADJUSTING AND CLEANING

A. Final Adjustments: Check and adjust seals, door bottoms, and other sound control hardware items right before final inspection. Leave work in complete and proper operating condition.

B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.

   1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible, rust-inhibitive, air-drying primer.

D. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 34 73.13
SECTION 08 36 13 - SECTIONAL 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 electrically operated sectional doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Flat door sections with sensor edge on bottom section.
2. Frame for paneled door sections; of each width of stile and rail required.
3. Panel for raised-panel door sections; not smaller than required to show raised-panel profile.
1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors 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. Failure of components or operators before reaching required number of operation cycles.
   c. Faulty operation of hardware.
   d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
   e. Delamination of exterior or interior facing materials.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
   1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: As indicated on Drawings.
   3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
      a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
      b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.
   4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

C. Windborne-Debris Impact Resistance: Provide sectional doors that pass missile-impact and cyclic-pressure tests according to ASTM E 1996 for Wind Zone 2.
   1. Large Missile Test: For overhead coiling doors located within 30 feet of grade.

D. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Component Importance Factor: 1.5.

2.3 DOOR ASSEMBLY

A. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Overhead Door Corporation.
b. Raynor.
c. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.

D. R-Value: 12.0 deg F x h x sq. ft./Btu.

E. Steel Sections: Zinc-coated (galvanized) steel sheet with G90 zinc coating.
   1. Section Thickness: 2 inches.
   2. Exterior-Face, Steel Sheet Thickness: 0.064-inch-nominal coated thickness.
      a. Surface: Flat.
   3. Insulation: Foamed in place.
   4. Interior Facing Material: Zinc-coated (galvanized) steel sheet with a nominal coated thickness of manufacturer's recommended dimension to comply with performance requirements.

F. Track Configuration: Vertical-lift track.

G. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.

H. Windows: Approximately 24 by 11 inches, with curved corners, and spaced apart the approximate distance as indicated on Drawings; in one row at height indicated on Drawings; installed with glazing of the following type:
   1. Insulating Glass: Manufacturer's standard.

I. Roller-Tire Material: Manufacturer’s standard.

J. Locking Devices: Equip door with slide bolt for padlock.

K. Counterbalance Type: Torsion spring.

L. Electric Door Operator:
   1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
   2. Operator Type: Manufacturer's standard for door requirements.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
   6. Obstruction-Detection Device: Automatic electric sensor edge on bottom section.
a. Sensor Edge Bulb Color: Black.

7. Control Station: Interior-side mounted.

M. Door Finish:
1. Baked-Enamel or Powder-Coat Finish: As indicated on Drawings.
2. Finish of Interior Facing Material: Finish as selected by Architect from manufacturer's full range.

2.4 MATERIALS, GENERAL
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.

2.5 STEEL DOOR SECTIONS
A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.

1. Fabricate section faces from single sheets to provide sections not more than 24 inches high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.

B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch-nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.

C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.

D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.

E. Provide reinforcement for hardware attachment.

F. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.

H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.6 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.

2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
   
   a. For Vertical Track: Continuous reinforcing angle attached to track and attached to wall with jamb brackets.

B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

C. Windows: Manufacturer's standard window units of type, size, and in arrangement indicated. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors and elastic glazing compound for wood doors, as required. Provide removable stops of same material as door-section frames.

2.7 HARDWARE

A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch-nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.

C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch-wide track and 2-inch-diameter roller tires for 2-inch-wide track.
D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.8 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.9 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.

C. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.

D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.

E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.10 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.

1. Electrical Characteristics:
   a. Phase: Polyphase.
   b. Volts: 208 V.
   c. Hertz: 60.

2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom section. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
   a. Self-Monitoring Type: Four-wire configured device designed to interface with door-operator control circuit to detect damage to or disconnection of sensor edge.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13
SECTION 08 36 20 - HANGAR DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of hangar doors:

1. Insulated steel framed, steel bottom rolling doors with prefinished siding on all exposed surfaces. Total length as indicated on the drawings.

B. Related Sections include the following:

1. Division 07 Section “Metal Wall Panels” and “Insulated-core Metal Wall Panels” for cladding of hangar doors.
2. Division 08 Section “Structured-Polycarbonate-Panel Assemblies” and “Glazing” for cladding and openings in hangar doors.
3. Division 26 Section "Conductors and Cables" for electrical service and connections for powered operators, and accessories.
4. Division 26 Section "Disconnect Switches and Circuit Breakers" for disconnect switches and circuit breakers for powered operators.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide steel bottom rolling doors capable of withstanding the effects of gravity and lateral loads and is designed so that horizontal and vertical deflections of the door structural members shall not exceed L/360 under full design wind load when the door is in the closed position. In addition, the door shall be designed so that deflection of any horizontal or vertical door member shall not exceed 2.5 inches under full design wind load, and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) as indicated on Structural Drawings.

B. Door manufacturer is required to coordinate with the contractor in the development of the exact installation details, and provide weights and door loadings to steel manufacturer.

C. Provide all necessary accessories not specifically noted as by building manufacturer and as required for complete installation.

D. The doors shall be engineered to resist all anticipated loads without sagging, bowing, nor conflicting with its smooth and efficient operation. Doors shall be equipped with completely pre-wired drive including all necessary mounting hardware and limit switches to prevent door from traveling beyond designed opening width. Electrically power slide door systems shall be opened and closed by means of power driven bottom roller or rollers with manual release clutches for manual operation in the event of power failure. The sliding doors shall have a control box with a minimum of three buttons marked as follows:
1. OPEN- “open button”, 2. STOP- “stop button”, and 3. CLOSE- “close button”. Door opening and closing rate shall be approximately 40 feet per minute. Electronically operated slide door system shall permit the door to be stopped and positively locked in position at any degree of door opening. Slide door shall be equipped with limit switches that automatically stop door operation at the full-open and full-closed positions. The door shall be fully automatic and fully controlled through the control box that is standard mounted to the lead edge of the drive panel, and sensing device to automatically reverse door if an obstruction is encountered. The door shall be capable of being operated from one side of the door. Hinge pins shall be minimum ¾ inch diameter aluminum. Button rollers shall have mask bearings, extra heavy-duty roller bearings on 3 inch wheels. Provide automatic jamb latches that activate when door if fully closed. The door shall be capable of being manually operated in the event of a power outage.

1.3 SUBMITTALS

A. Product Data: For each type and size of steel bottom rolling door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs.
3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Delegated Design Submittal: Submit design calculations covering door structure, all operating devices, mechanical systems and “U” value. A Registered Professional Engineer shall prepare and sign structural calculations.

C. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer’s data sheets.

1. Detail all components of the door and track assembly. Indicate interface with other building components. Show all details for construction, installation and operation; size, shapes and thickness of materials, joints and connections; reinforcing; hardware; mechanical devices; electrical devices; and all design and detail data for work of other trades affected by hangar doors.
2. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
1. Panel: 6 inches square.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the steel bottom rolling door manufacturer for both installation and maintenance of units required for this Project. Mechanics shall be skilled and experienced in the erections of hangar doors of type and size required for this project.

B. Manufacturer Qualifications: Engage a firm experienced in steel bottom rolling doors similar to those indicated for this Project and with a record of successful in-service performance.

1. Installation of the door(s) shall be supervised by a manufacturer's representative and shall be in accordance with approved shop drawings.

C. Source Limitations: Obtain steel bottom rolling doors through one source from a single manufacturer.

1. Obtain operators and controls from the steel bottom rolling door manufacturer.

D. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Warranty: the steel bottom rolling door system, including all associated mechanical and electrical components, shall be guaranteed by the manufacturer for three years from the date of Project Acceptance of the building against all defects in materials, workmanship and problems which arise through the normal anticipated use of the door.

1.5 ASSIGNMENT OF SPECIALISTS

A. Certain sections of the Specifications require that specialists who are recognized experts in the operation to be performed shall perform specific construction activities. The specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

B. Material provided under this Section shall be engineered and assembled into a product manufactured by one of the manufacturers specified in this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:

1. Aero Systems, Corp.
2. D.P. Industries Inc.
3. International Door, Inc.
4. JB Mathews Co./Aero-Door
5. REID Steel
7. Wilson Doors

B. Source Limitations: Manufacturer shall obtain and is responsible of all components specified within this section for a complete hanger door installation.

2.2 FABRICATION

A. Doors: Door leaves shall be of welded or bolted construction. Joints shall develop 100 percent of the strength of the framing members. Vertical members shall be continuous throughout the height of the door. When required, prepare splices to facilitate field assembly in accordance with standard practice. Frames and framing members shall be true to dimensions and square in all directions; no leaf shall be bowed, warped, or out of line in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Provide diagonal bracing so that the completed leaf assembly will be braced to withstand shipping, assembly, and operational loads. Exposed welds and welds which would interfere with the installation of various parts such as cover sheets shall be sufficiently ground smooth to remove all encumbrances.

B. Locking Devices: Do not provide locking devices on motor-operated hangar doors.

C. Tractor Pulls: Provide tractor pulls so that leaves can be towed by a tractor or similar equipment in the event of power failure. The tractor shall be designed for drive force to tow door or 5000 pounds whichever is greater. Minimum thickness steel plate shall be 3/8 inch.

D. Track Cleaners: Provide a device to clear debris from the rail head and wheel flange grooves as the leaf is moved.

E. Bottom rollers shall be solid steel with tapered roller bearings, and a greasable axle assembly. Bottom rollers shall be removable for purposes of repair, without disturbing any other door components except the drive rollers. Bottom rollers shall be of steel plate, having a minimum tread diameter of 15 inches or as required for the actual roller loading. Construct roller assemblies to permit removal of the rollers without removing the door leaf from its position on the rail.

1. Treads: Machine roller treads concentric with bearing seats. The clear distance between flanges shall not exceed the width of the rail by more than 1/8 inch at the tread nor more than ¼ inch at the edge of the flange. Machine internal bearing seats accurately for a press it. Heat treat rollers 18 inches or greater in diameter to obtain a rim hardness of 320 Brinnel.
2. Roller Bearings: Provide tapered roller or spherical bearings, either internal or cartridge type, arranged so that both horizontal and vertical loads shall be transferred to the rail only through the bearing. Bearings shall be tightly sealed and equipped with high-pressure grease fittings.

F. Fixed position top roller brackets shall allow for vertical travel: 4-inch minimum up and 4-inch minimum down from the lowest elevation of the as erected supporting element. Opening requirements for locating vertical travel datum for fixed position roller brackets shall be field measured after roof deck, roofing, and fascia cladding are installed.

G. Fixed top roller bracket shall keep the door panels attached to the upper guide beams in the event of derailment from bottom tracks.

H. Brush seals shall be provided to seal the bottom. Two-ply fiber reinforced neoprene rubber shall be provided at the top of the slide door panels.

I. Weather Stripping: Provide adjustable and readily replaceable material. Provide on vertical edges, sills, and heads to afford a weather-tight installation.

   1. Neoprene/EPDM: Use flap-type, two-ply, cloth-inserted neoprene (EPDM) or extruded, double flap, single or dual opposed solid neoprene material on vertical edges and sills. The two-ply material shall have a minimum thickness of 1/8 inch and shall be retained continuously for its full length and secured with rust-resistant fasteners 12 inches o.c. Extruded weather stripping with heavy center section shall be attached 12 inches o.c., but continuous bar may be omitted. Clearance between metal parts on vertical edges of leaves and between leaves and jambs which are to be weather-stripped shall be as indicated.

J. Glazing: See Section 088000 “Glazing” for non blast insulated glazing type to be installed with the doors.

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Provide steel track system, sized for door size and weight. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of guides for required door type and size.

2.4 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

B. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit track.

C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

D. Provide safety interlock switch to disengage power supply when door is locked.
2.5 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified, complete with electric motor and factory-rewired disconnect switch, motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation. Coordinate location of assemblies with the Architect. Each door shall have its own motor. Each door shall have safe opening and closure systems, which shall be controlled by a handheld cable in order that the operator may walk clear of the door.

1. Comply with NFPA 70.

B. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnects and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

1. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
2. 480 Volt, 3 phase motors.

C. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position. Motor push button control station and all electrical components shall be installed in accordance with the National Electrical Code.

D. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops door travel.

1. Photoelectric Sensor: Manufacturer’s standard system designed to detect an obstruction in door opening without contact between door and obstruction.
   a. Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

E. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

2.6 METAL SIDING

A. On exterior side of hangar doors provide prefinished insulated metal panels with concealed fasteners. Basis-of-design: Centria Versawall panel, as indicated in Division 07 Section “Insulated Metal Wall Panels”.

B. On interior side of hangar doors provide perforated panel liner. Basis-of-design: Centria Quiet Wall System as indicated in Division 07 Section “Metal Wall Panels”, color: #179 Regal White.
C. Install in compliance with requirements of Division 07 Section, “Metal Wall Panels” and “Insulated Metal Wall Panels”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.

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

3.2 INSTALLATION

A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

B. Fasten vertical track assembly to framing at manufacturer’s recommended spacing. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of door-operating equipment.

C. The manufacturer of the hangar doors shall provide a qualified field engineer to supervise the installation and perform the inspection services specified hereinafter. The field engineer shall furnish duplicate copies of his report to the Contractor Quality Control Representative within 24 hours following each inspection. The Contractor shall furnish a copy of the field inspection engineer's report to the CQC Representative within 48 hours and shall perform the following:

1. Inspect doors during job site unloading, sub-assembly and prior to erection.
2. Inspect installation of rails and other embedded items before pouring of fill concrete to ensure that the elevation and alignment indicated have been complied with and that rails are level to the specified tolerance.
3. Recheck rails and other embedded items to verify the accuracy of dimensions.
4. Provide recommendations for any necessary corrective action.
5. Inspect final erection and assembly of door leaves for alignment and fit, and clearance between doors and building, and between individual door leaves.
6. Inspect setting of all seals in the closed position to assure an airtight installation.
7. Inspect the positioning and fit of pivot assemblies.
8. Inspect the mating of lock pins with receptacles.
9. Inspect all fasteners to assure that all screws and bolts are properly secured to prevent loosening.
10. Inspect all field welds in accordance with AWS D1.1/D1.1M.
11. Check all drive assemblies and lock pins for smooth operation and that all lubrication has been accomplished.
12. Verify that all gear boxes and bearings have been lubricated.
3.3 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

B. Adjust belt-driven motors as follows:
   1. Use adjustable motor-mounting bases for belt-driven motors.
   2. Align pulleys and install belts.
   3. Tension belt according to manufacturer's written instructions.

3.4 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   2. Train Owner's maintenance personnel on procedures and schedules related to operation, troubleshooting, servicing, and preventive maintenance.
   3. Send report of startup to Contracting Officer.

B. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 08 36 20
SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior manual-swing entrance doors and door-frame units.
   2. Exterior Storefront Assemblies

B. Related Requirements:
   1. Section 08 04 00 "Blast Resistance" for door, frame, and glazing protection requirements.
   2. Section 08 05 00 "Common Work Results for Openings" for AT/FP analysis and door frame connection, mullion, and glazing requirements

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
1. 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. Glazing.

2. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   5. Flashing and drainage.

F. 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.

G. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and field testing agency.

B. 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.

C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C1401. Include periodic quality-control reports.

E. Source quality-control reports.
F. Field quality-control reports.
G. Sample Warranties: For special warranties.
H. All test results shall be a required submittal to the Government.
I. Contractor shall submit qualifications of any required Independent Testing and Inspection Agent in advance for Government approval.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE
A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
C. 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 Contracting Officer, except with Contracting Officer’s approval. If changes are proposed, submit comprehensive explanatory data to Contracting Officer for review.

1.7 PRECONSTRUCTION LABORATORY MOCKUPS
A. Preconstruction Testing Service: 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 by Contracting Officer.
   2. Notify Contracting Officer seven 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.
3. Water Penetration under Static Pressure: ASTM E 331.
5. Structural: ASTM E 330 at 100 percent of positive and negative test loads. Repeat the following:
   b. Water Penetration under Static Pressure: ASTM E 331.
6. Vertical Interstory Movement: AAMA 501.7. Repeat the following:
   b. Water Penetration under Static Pressure: ASTM E 331.
7. Thermal Cycling: According to AAMA 501.5. Repeat the following:
   b. Water Penetration under Static Pressure: ASTM E 331.
8. Structural: ASTM E 330 at 100 and 150 percent of positive and negative test loads. Repeat the following:
   b. Water Penetration under Static Pressure: ASTM E 331.
9. AT/FP Criteria: Reference Section 08 80 00 “Glazing”.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.
   e. Failure of operating components.

2. Warranty Period: 10 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: 20 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 01 40 00 "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 Structural Drawings.
2. Other Design Loads: Framing members and connections shall be designed to withstand blast loading from designated weapon and standoff distance in accordance with UFC 4-010-01.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
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 for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

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 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Entrance Doors: 
      a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

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.

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.
   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. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   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.

J. 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 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 0.45 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 35 as determined according to NFRC 500.

K. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.


L. Blast Resistance:

1. Furnish entrances and storefront assemblies complying with the latest UFC 4-010-01 the DoD Anti- Terrorism Standard for Buildings and loads indicated in Section 08 05 00 “Common Work Results for Openings, and Section 08 80 00 “Glazing”.

2. Furnish windows and storefront assemblies that are not transmitting excessive loads to the structure at the design blast load. Windows should have test results and calculations that will demonstrate the ability of the window to be anchored into the type of wall specified in the project.

M. 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 4.

1. Large-Missile Test: For glazed openings located within 30 feet of grade.

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

1. Temperature Change: 120 deg F, ambient; 180 deg F, 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.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:


2. Oldcastle Building Envelope.

3. YKK AP America Inc.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels 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.

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.
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 2-inch overall thickness, with minimum 0.125-inch-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. Provide cavity in frames for electrical wiring to hinge nearest to electrical controlled door device.
   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
2. Door Design: Medium stile; 3-1/2-inch nominal width.
   a. Provide nonremovable glazing stops on outside of door.
2.5 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.

1. Entrance 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.

3. Opening-Force Requirements:
   a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.

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. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.

E. 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.

F. Cylinders: BHMA A156.5, Grade 1. As specified in Section 087100 "Door Hardware."

1. Keying: Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

G. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

H. Operating Trim: BHMA A156.6.

I. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

J. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

K. Weather Stripping: Manufacturer's standard replaceable components.
1. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

L. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

M. Silencers: BHMA A156.16, Grade 1.

N. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.6 GLAZING

A. Glazing: Comply with Section 08 80 00 "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. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.


D. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.


2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

   2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch 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.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. 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.

E. 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.

F. 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.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and 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.
1. Color and Gloss: As selected from manufacturer's full range.

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 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.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 08 80 00 "Glazing."

F. 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.

G. 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.
3.3 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; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
   c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: 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.

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 tests in areas as directed by Contracting Officer.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 08 41 13
SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

B. Related Requirements:
   1. Section 08 04 00 "Blast Resistance" for glazing protection requirements.
   2. Section 08 05 00 "Common Work Results for Openings" for AT/FP analysis and frame connection, mullion, and glazing requirements

1.2 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

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.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
   3. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.

C. Shop Drawings: For glazed aluminum curtain walls. 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 glazed aluminum curtain walls, 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 lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   5. Flashing and drainage.

G. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. 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 and laboratory mockup testing agency and field testing agency.

C. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

D. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.

E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.6 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 Contracting Officer, except with Contracting Officer’s approval. If changes are proposed, submit comprehensive explanatory data to Contracting Officer for review.
1.7 PRECONSTRUCTION LABORATORY MOCKUPS

A. Preconstruction Testing Service: 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 directed by Contracting Officer.
   2. Notify Contracting Officer seven 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.
   3. Water Penetration under Static Pressure: ASTM E 331.
   5. Structural: ASTM E 330 at 100 percent of positive and negative test loads. Repeat the following:
      b. Water Penetration under Static Pressure: ASTM E 331.
   6. Thermal Cycling: According to AAMA 501.5. Repeat the following:
      b. Water Penetration under Static Pressure: ASTM E 331.
   7. Structural: ASTM E 330 at 100 and 150 percent of positive and negative test loads. Repeat the following:
      b. Water Penetration under Static Pressure: ASTM E 331.

1.8 WARRANTY

A. Special Assembly Warranty: Manufacturer and Installer agrees to repair or replace components of glazed aluminum curtain wall 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: 10 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: 20 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 01 40 00 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls 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 Structural Drawings.
2. Other Design Loads: Framing members and connections shall be designed to withstand blast loading from designated weapon and standoff distance in accordance with UFC 4-010-01.

D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

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 for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

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 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Fixed Framing and Glass Area:
      a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

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 15 lbf/sq. ft.

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 15 lbf/sq. ft.
   2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   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.
J. 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 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 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 45 as determined according to NFRC 500.

K. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows:

1. Outdoor-Indoor Transmission Class: Minimum 34.

L. Blast Resistance:

1. Furnish entrances and storefront complying with the latest UFC 4-010-01 the DoD Anti Terrorism Standard for Buildings and loads indicated in Section 088000 “Glazing”.
2. Furnish windows that are not transmitting excessive loads to the structure at the design blast load. Windows should have test results and calculations that will demonstrate the ability of the window to be anchored into the type of wall specified in the project.

M. 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.

1. Large-Missile Test: For glazed openings located within 30 feet of grade.

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

1. Temperature Change: 120 deg F, ambient; 180 deg F, 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.
   b. Low Exterior Ambient-Air Temperature: 0 deg F.

O. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kawneer.
2. Oldcastle, Inc.
3. YKK AP America Inc.

B. Source Limitations: Obtain all components of curtain wall system, including framing entrances, sun control 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.

2. Glazing System: Retained mechanically with gaskets on four sides.
5. Fabrication Method: Either factory- or field-fabricated system.

B. Pressure Caps: Manufacturer’s standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

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.
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   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 ENTRANCES
   A. Entrances: Comply with Section 08 41 13 "Aluminum-Framed Entrances and Storefronts."

2.5 SUN CONTROL
   A. Sunshades: Assemblies consisting of manufacturer’s standard outrigger brackets, louvers, and fascia, designed for attachment to curtain wall with mechanical fasteners.
   B. Basis of Design Product: Kawneer Versoleil Sunshade Outrigger System. Subject to Compliance with requirements, provide the products by the manufacturer listed as the basis of design products. Comparable products by listed manufacturers or another manufacturer may be submitted to the Government for approval.
      1. Unit Depth: 30 inches.
      2. Unit Width: Refer to drawings.
   C. Provide by window manufacturer as part of the overall system.

2.6 GLAZING
   A. Glazing: Comply with Section 08 80 00 "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. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less.
   D. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
   E. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.

2.7 ACCESSORIES
   A. Fasteners and Accessories: Manufacturer’s standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
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 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.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends cope 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 exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   7. Components curved to indicated radii.

D. Fabricate components to resist water penetration as follows:
   1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
   2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

F. Factory-Assembled Frame Units:
   1. Rigidly secure nonmovement joints.
   2. Prepare surfaces that are in contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
   3. Preparation includes, but is not limited to, cleaning and priming surfaces.
   4. Seal joints watertight unless otherwise indicated.
   5. Install glazing to comply with requirements in Section 08 80 00 "Glazing."

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and 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.
   1. Color and Gloss: As selected from manufacturer's full range.

2.10 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 will contact 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. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal 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 primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

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 08 80 00 "Glazing."

1. Prepare surfaces that will contact 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.

G. Install weatherseal sealant according to Section 07 92 00 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Test Area: Perform tests on mockups. Coordinate locations with Contracting Officer.

C. Field Quality-Control Testing: Perform the following test on mockups.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Contracting Officer shall be tested according to AAMA 501.2 and shall not evidence water penetration.
   a. Perform a minimum of three 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.

2. Air Infiltration: ASTM E 783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
   a. Perform a minimum of three 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.

3. Water Penetration: ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 08 44 13
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 aluminum-framed assemblies glazed with structured-polycarbonate panels as
      follows:
      1. Wall 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 construction details, material descriptions, dimensions of individual components
         and profiles, and finishes for aluminum components of panel assemblies.
   B. Sustainable Design Submittals:
      1. Product Data: For sealants, indicating VOC content.
      2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-
         emitting materials.
   C. Shop Drawings: For panel assemblies.
      1. Include plans, elevations, sections, details, and attachments to other work.
      2. Include details of provisions for assembly expansion and contraction and for draining
         moisture within the assembly to the exterior.
   D. Samples: In manufacturer's standard size.
      1. For each type of structured-polycarbonate panel.
      2. For each type of exposed finish for framing members.
E. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch lengths of full-size framing members and showing details of the following:

1. Joinery.
2. Anchorage.
5. Flashing and drainage.

F. Delegated-Design Submittal: For panel assemblies 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. Qualification Data: For qualified Installer.

B. Product Test Reports: For each structured-polycarbonate-panel assembly, for tests performed by a qualified testing agency.

C. Evaluation Reports: For structured-polycarbonate-panel assemblies from ICC-ES.

D. Field quality-control reports.

E. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.7 QUALITY ASSURANCE

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

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical panel assemblies as shown on Drawings.
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.
1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies 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. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   c. Water leakage.

2. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace structured-polycarbonate panels that exhibit defects in materials or workmanship within specified warranty period.

1. Defects include, but are not limited to, the following:
   a. Delamination.
   b. Color changes exceeding requirements.
   c. Losses in light transmission beyond 6 percent from original when measured according to ASTM D 1003.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.

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 structured-polycarbonate-panel assemblies.

B. Structural Loads: As indicated on Drawings.

C. Deflection Limits:

1. Vertical Panel Assemblies: Limited to 1/120 of clear span for each assembly component.
D. Structural-Test Performance: Panel assemblies tested according to ASTM E 330, as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified deflection limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Windborne-Debris-Impact-Resistance Performance: Panel assemblies that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and the testing information in ASTM E 1996 for Wind Zone 2.
   1. Large-Missile Test: For glazed openings located within 30 feet of grade.
   2. Small-Missile Test: For glazed openings located more than 30 feet above grade.

F. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.

H. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:
   1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.65 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
   2. Solar-Heat-Gain Coefficient (SHGC): Fixed glazing and framing areas shall have an SHGC of no greater than 0.6 as determined according to NFRC 200.
   3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft..
2.2  STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

A.  Basis-of-Design Product:  The design for assemblies is based on CPI Daylighting, Inc., Quadwall (SPP-2) and UniQuad (SPP-1). Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1.  Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a.  CO-EX Corp.
   b.  Duo-Gard Industries Inc.
   c.  Energy-Glazed Systems, Inc.
   d.  Gallina USA, LLC.
   e.  Major Industries, Inc.
   f.  Super Sky Products Inc.
   g.  Kalwall Corp.

2.3  STRUCTURED-POLYCARBONATE PANELS

A.  Structured-Polycarbonate Panels:  Translucent, extruded-polycarbonate sheet with multiwall cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.


B.  UV Resistance:  On both surfaces.

C.  Color:  As indicated on Drawings.

D.  Panel Performance:

1.  Plastic Self-Ignition Temperature:  650 deg F or more according to ASTM D 1929.
2.  Smoke-Developed Index:  450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
3.  Combustibility Classification:  Class CC1 based on testing according to ASTM D 635.
4.  Interior Finish Classification:  Class A based on testing according to ASTM E 84.
5.  Color Change:  Not more than 3.0 units Delta E, when measured according to ASTM D 2244, after outdoor weathering compliant with procedures in ASTM D 1435.
6.  Impact Resistance:  No failure at impact of 200 ft. x lbf according to freefalling-ball impact test using a 3-1/2-inch-diameter, 6.3-lb ball.
7.  Haze Factor:  Greater than 90 percent when tested according to ASTM D 1003.
2.4 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
   1. At closures, retaining caps, or battens, use ASTM A 193, 300 series stainless-steel screws.
   2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.


G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Exposed Flashing and Closures: Aluminum sheet not less than 0.063 inch thick, finished to match framing.

I. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining structured-polycarbonate panels.

J. Frame-System Sealants: As recommended in writing by manufacturer.
   1. Sealant shall have a VOC content of 250 g/L or less.

K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
2.5 FABRICATION
   A. Fabricate aluminum 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 cope or mitered.
      3. Internal guttering systems or other means to drain water passing through joints and moisture migrating within assembly to exterior.
   B. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
   C. Reinforce aluminum components as required to receive fastener threads.

2.6 ALUMINUM FINISHES
   A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
      1. Color and Gloss: As indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. General: Comply with manufacturer's written instructions.
      1. Do not install damaged components.
      2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
      3. Rigidly secure nonmovement joints.
      4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
      5. Seal joints watertight unless otherwise indicated.
   B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
C. Install components plumb and true in alignment with established lines and elevations.

D. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.
2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.

   a. Test Procedures: Test under uniform and cyclic static-air pressure.
   b. Static-Air-Pressure Difference: 0.67 times the pressure specified for laboratory testing according to ASTM E 331 is a realistic criterion.
   c. Water Penetration: None.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

END OF SECTION 08 45 13
SECTION 08 71 00 – DOOR HARDWARE

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes furnishing and installation of door hardware for doors specified in “Hardware Sets” and required by actual conditions. Including screws, bolts, expansion shields, electrified door hardware, and other devices for proper application of hardware.

B. Where items of hardware are not specified and are required for intended service, such omission, error or other discrepancy to be submitted to Architect fourteen calendar days prior to bid date for clarification by addendum.

C. Products supplied but not installed under this Section:

1. Hardware for aluminum doors will be furnished under this Section, but installed under Division 08 Openings.
2. Final replacement of cylinder cores to be installed by Owner.
3. Hold open wall magnets.
4. Electrified hardware will be furnished under this Section, but installed by the security contractor.

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

E. Related Divisions:

1. Division 08 Openings
2. Division 26 Electrical
3. Division 28 Electronic Safety And Security

1.2 REFERENCES

A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):

1. ANSI/BHMA A156.1 Butts & Hinges (2006)
2. ANSI/BHMA A156.3 Exit Devices (2014)
3. ANSI/BHMA A156.4 Door Controls – Closers (2008)
4. ANSI/BHMA A156.6 Architectural Door Trim (2010)
5. ANSI/BHMA A156.7 Template Hinge Dimensions (2009)
6. ANSI/BHMA A156.8 Door Controls – Overhead Stops and Holders (2010)
7. ANSI/BHMA A156.13 Mortise Locks & Latches (2005)
8. ANSI/BHMA A156.16 Auxiliary Hardware (2008)
11. ANSI/BHMA A156.21 Thresholds (2009)

B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:  

C. Underwriters Laboratories, Inc. (UL):  
   1. UL 10C Positive Pressure Fire Test of Door Assemblies.  
   2. UL 1784 Air Leakage Test of Door Assemblies.  
   3. UL/ULC Listed.  

D. Door and Hardware Institute (DHI):  
   2. DHI Publication – Abbreviations and Symbols.  

E. National Fire Protection Agency (NFPA):  
   1. NFPA 70 National Electrical Code 2008  
   2. NFPA 80 Standard for Fire Doors and Other Opening Protectives 2007  
   4. NFPA 105 Standard for the Installation of Smoke Door Assemblies 2007  

F. Building Codes:  
   1. IBC International Building Code 2009  
   2. Local Building Code.  

1.3 SUBMITTALS  

A. Submit in accordance with Conditions of the Contract and Division 1 Administrative Requirements.  

B. Shop Drawings:  
   1. Organize hardware schedule organized in vertical format illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and symbols page according to DHI Publications Abbreviations and Symbols. Complete nomenclature of items required for each door opening as indicated.  
   2. Coordinate final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.  
   3. Architectural Hardware Consultant (AHC), as certified by DHI, who shall affix seal attesting to completeness and correctness, shall review hardware schedule prior to submittal.
C. Submit manufacturer’s catalog sheet on design, grade and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide index, and cover sheet.

D. Coordination: Distribute door hardware templates to related divisions within fourteen days of receiving approved door hardware submittals.

E. Electrified Hardware: Provide electrical information to include voltage, and amperage requirements for electrified door hardware and description of operation.

   1. Description of operation for each electrified opening to include description of component functions including location, sequence of operation and interface with other building control systems.
   2. Wiring Diagrams: Detail wiring for power, signal, and control system and differentiate between manufacturers installed and field installed wiring. Include the following:
      a. System schematic.
      b. Point to point wiring diagram.
      c. Riser diagram.
      d. Elevation of each door.
   3. Detail interface between electrified door hardware and fire alarm, access control, security, and building control systems.
   4. Provide junction boxes, relays and terminal blocks as needed for proper door operations and connections.

F. Upon door hardware submittal approval, furnish for each electrified opening, three copies of point to point diagrams.

G. Closeout Submittals: Submit to Owner in a three-ring binder or CD if requested.

   1. Warranties.
   3. Maintenance service agreement.
   4. Record documents.
   5. Copy of approved hardware schedule.
   6. Copy of approved keying schedule with bitting list.
   7. Door hardware supplier name, phone number and fax number.

1.4 QUALITY ASSURANCE

A. Listed and Labeled electrified door hardware as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction.

B. Hardware supplier shall employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who shall be available at reasonable times during course of work for Project hardware consultation.

   1. Electrified Door Hardware Supplier Qualifications: Experienced door hardware supplier who has completed projects with electrified door hardware 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.
C. Door hardware conforming to ICC/ANSI A117.1: Handles, pulls, latches, locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

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 or labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.

E. Fire Door Inspection: Prior to receiving certificate of occupancy have fire rated doors inspected by an independent certified Fire and Egress Door Assembly Inspector (FDAl), as certified by Intertek (ITS), a written report shall be submitted to Owner and Contractor. Doors failing inspection shall be adjusted, replaced or modified to be within appropriate code requirements.

F. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

G. Door hardware certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.

H. Substitution request: Include the reason for requesting the substitution, clear catalog copy highlighting the proposed product and options, compliance statement, technical data, product warranty and lead time, to show how the proposed can meet or exceed established level of design, function, and quality. Approval of request is at the discretion of the owner, architect, and their designated consultants.

I. Pre-installation Meeting: Comply with requirements in Division 1 Section “Project Meetings”.

   1. Convene meeting seven days before installation. Participants required to attend: Contractor, installer, material supplier, manufacturer representatives, electrical contractor, security consultant, and fire alarm consultant.
   2. Include in-conference decisions regarding proper installation methods and procedures for receiving and handling hardware.
   3. Review sequence of operation for each type of electrified door hardware, inspect, and discuss electrical roughing-in and other preparatory work performed by other trades.
   4. Review and finalize construction schedule and verify availability of materials, installer’s personnel, equipment and facilities needed to make progress and avoid delays.

J. Within fourteen days of receipt of approved door hardware submittals contact Owner with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock. Provide keying system per Owner’s instructions.

K. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.

L. Hardware listed in 3.07 - Hardware Schedule is intended to establish type and grade.
1.5 DELIVERY, STORAGE AND HANDLING

A. Provide clean, dry and secure room for hardware delivered to Project but not yet installed.

B. Furnish hardware with each unit marked and numbered in accordance with approved finish hardware schedule. Include door and item number for each type of hardware.

C. Pack each item complete with necessary parts and fasteners in manufacturer’s original packaging.

D. Deliver permanent keys, cores and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to Owner shall be established at “Keying Conference.”

E. Waste Management and Disposal: Separate waste materials for reuse or recycling in accordance with Division 1.

1.6 WARRANTY

A. General Warranty: Owner may have under provisions of the Contract Documents and be an addition and run concurrent with other warranties made by Contractor under requirements of the Contract documents.

B. Special Warranty: Warranties specified in this article shall not deprive Owner of other rights.

1. Ten years for manual door closers.
2. Five years for mortise, auxiliary and bored locks.
3. Five years for exit devices.
4. One year for electromechanical door hardware.

C. Replace or repair defective products during warranty period in accordance with manufacturer’s warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse and failure to exercise normal maintenance.

D. Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner’s continued adjustment, maintenance, removal and replacement of door hardware.

PART 2 – PRODUCTS

2.1 HINGES

A. Hinges, electric hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following:

C. Butt Hinges:

1. Hinge weight and size unless otherwise indicated in hardware sets:
   a. Doors up to 36” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .134” and a minimum of 4-1/2” in height.
   b. Doors from 36” wide up to 42” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .145” and a minimum of 4-1/2” in height.
   c. For doors from 42” wide up to 48” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .180” and a minimum of 5” in height.
   d. Doors greater than 1-3/4” thick provide hinges with a minimum thickness of .180” and a minimum of 5” in height.
   e. Width of hinge is to be minimum required to clear surrounding trim.

2. Base material unless otherwise indicated in hardware sets:
   a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
   b. Interior Doors: Steel material.
   c. Fire Rated Doors: Steel or 304 Stainless Steel materials.
   d. Stainless Steel ball bearing hinges to have stainless steel ball bearings. Steel ball bearings are unacceptable.

3. Quantity of hinges per door unless otherwise stated in hardware sets:
   a. Doors up to 60” in height provide 2 hinges.
   b. Doors 60” up to 90” in height provide 3 hinges.
   c. Doors 90” up to 120” in height provide 4 hinges.
   d. Doors over 120” in height add 1 additional hinge per each additional 30” in height.
   e. Dutch doors provide 4 hinges.

4. Hinge design and options unless otherwise indicated in hardware sets:
   a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
   b. Out-swinging exterior and out-swinging access controlled doors shall have Non-Removable Pins (NRP) to prevent removal of pin while door is in closed position.
   c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
   d. Electric Through-Wire (ETW) to have appropriate number of wires to transfer power through door frame to door for proper connection of finish hardware and certified to handle an amperage rating of 3.5AMPS/continuous duty with 16.0AMPS/intermittent duty.
   e. Provide mortar boxes for frames that require any electrically modified hinges if not an integral part of frame.
   f. When shims are necessary to correct frame or door irregularities, provide metal shims only.

5. Acceptable Manufacturers:
   a. Hager: BB1191
   b. Bommer: BB5002
   c. McKinney: TA2314

   Standard Weight: Heavy Weight
   a. Hager: BB1191
   b. Bommer: BB5002
   c. McKinney: TA2314
2.2 CONTINUOUS HINGES

A. Continuous hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following: Continuous Hinges: ANSI/BHMA A156.26 Grade 1.

C. Continuous Geared Hinges:
   
   1. Determine model number by door and frame application, door thickness, frequency of use, and fire rating requirements according to manufacturer’s recommendations.
      a. Length of hinge shall be 1” less door height unless otherwise stated in hardware sets.

D. Material and Design:
   
   1. Base material: Anodized aluminum manufactured from 6063-T6 material, unexposed working metal surfaces shall be coated with TFE dry lubricant.
   2. Bearings:
      a. Vertical loads shall be carried on Lubriloy RL bearings for non-fire rated doors.
      b. Continuous hinges shall have a minimum spacing between bearings of 2-9/16”. Typical door from 80” to 84” in height to have a minimum of 32 bearings.
   3. Options:
      a. Removable Electric Through-Wire (RETW) shall have appropriate number of wires to transfer power through door frame to door for proper connection of finish hardware. Provide RETW in a form that can be removed for connection, servicing without removing entire hinge from door and frame, and certified to handle an amperage rating of 3.5AMPS/continuous duty with 16.0AMPS/intermittent duty.
      b. Hinges to have Rounded Back Cover Channel (RBCC).
      c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
      d. Fire rated hinges shall carry UL certification, up to and including 90-minute applications for wood doors and up to 3-hour applications for metal doors.

E. Acceptable Manufacturers:

   Heavy Duty
   1. Hager: 780-112HD
   2. Bommer: FMSLFHD
   3. Zero: 910A

2.3 FLUSH BOLTS AND COORDINATORS

A. Flush bolts of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following: Auxiliary Hardware: ANSI/BHMA A156.16.
C. Labeled openings: Provide automatic or constant latching flush bolts per hardware schedule for inactive leaf of pairs of doors. Provide dust proof strikes for bottom bolt.

D. Non-Labeled openings: Provide two flush bolts for inactive leaf of pairs of doors per hardware schedule. Top bolt shall not be more than 78” centerline from floor. Provide dust proof strike for bottom bolt.

E. Acceptable Manufacturers:

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Manual Flush Bolt</th>
<th>Auto Flush Bolt</th>
<th>Dust Proof Strike</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hager:</td>
<td>282D</td>
<td>292D</td>
<td>280X</td>
</tr>
<tr>
<td>2. Rockwood:</td>
<td>555</td>
<td>1942</td>
<td>570</td>
</tr>
<tr>
<td>3. Trimco:</td>
<td>3917</td>
<td>3815</td>
<td>3911</td>
</tr>
</tbody>
</table>

F. Coordinators: Provide for labeled pairs of doors with automatic flush bolts or with vertical rod exit device with a mortise-locking device per hardware schedule. Provide filler piece to extend full width of stop on frame. Provide mounting brackets for closers and special preparation for latches where applicable.

G. Acceptable Manufacturers:

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Coordinator</th>
<th>Bracket</th>
<th>Bracket for stops greater than 2-1/4”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hager:</td>
<td>297</td>
<td>297M</td>
<td>297N</td>
</tr>
<tr>
<td>2. Rockwood:</td>
<td>1600</td>
<td>1601AB</td>
<td>1601C</td>
</tr>
<tr>
<td>3. Trimco:</td>
<td>3094</td>
<td>3095</td>
<td>3096</td>
</tr>
</tbody>
</table>

2.4 LOCKS AND LATCHES

A. Locks and latches of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Product to be certified and listed by following:

1. ANSI/BHMA A156.13 Series 1000 Certified to Grade 1 for Operational and Security.
2. UL/cUL Labeled and listed up to 3 hours for single doors up to 48” in width and up to 96” in height.
3. UL10C/UBC 7-2 Positive Pressure Rated.

C. Lock and latch function numbers and descriptions of manufacturer’s series as listed in hardware sets.

D. Material and Design:

1. Lock cases from fully wrapped, 12 gauge steel, zinc dichromate for corrosion resistance.
2. Non-handed, field reversible without opening lock case.
3. Break-away spindles to prevent unlocking during forced entry or vandalism.
4. Levers, zinc cast, forged brass or stainless steel and plated to match finish designation in hardware sets.
5. Sectional Roses, solid brass or stainless steel material and have a minimum diameter of 2-7/16”.
6. Armor fronts, self-adjusting to accommodate a square edge door or a standard 1/8” beveled edge door.

E. Latch and Strike:

1. Stainless steel latch bolt with minimum of 3/4” throw and deadlocking for keyed and exterior functions.
2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4” x 4-7/8” with proper lip length to protect surrounding trim.
3. Deadbolts to be 1-3/4” total length with a minimum of a 1” throw and 3/4” internal engagement when fully extended and made of stainless steel material.

F. Electric Locks

1. Fail-Safe (power lock): Outside trim is locked when power is applied and unlocked when power is removed. Lockset will unlock in the event of a power failure (EL).
2. Fail-Secure (power unlock): Outside trim is locked when there is no power and unlocked when power is applied. Lockset will be locked in the event of a power failure (EU).

G. Acceptable Manufacturers:

1. Hager: 3800 Series
2. Best: 45H Series
3. Sargent: 8200 Series

2.5 EXIT DEVICES

A. Exit Devices of one manufacturer as listed for continuity of design and consideration of warranty. Touch pad type, finish to match balance of door hardware.

B. Standards: Manufacturer to be certified and or listed by the following:

1. BHMA Certified ANSI A156.3 Grade 1.
2. UL/cUL Listed for up to 3 hours for “A” labeled doors.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. UL10B Neutral Pressure Rated.
5. UL 305 Listed for Panic Hardware.

C. Material and Design:

1. Touch pad shall extend a minimum of one half of door width. Freewheeling lever design shall match design of lock levers. Exit device to mount flush with door.
2. Latchbolts:
   a. Rim device – 3/4” throw, Pullman type with automatic dead-latching, stainless steel
   b. Surface vertical rod device – Top 1/2” throw, Pullman type with automatic dead-latching, stainless steel. Bottom 1/2” throw, Pullman type, held retracted during door swing, stainless steel.
3. Fasteners: Wood screws, machine screws, and thru-bolts.

D. Lock and Latch Functions: Function numbers and descriptions of manufacturer’s series and lever styles indicated in door hardware sets.

E. Electric Modifications:
   1. Motorized Latch Retraction: An electric motor retracts the latch bolt for momentary or maintained periods of time.
   2. Electrified Trim: Outside trim locked (EL) or unlocked (EU) by electric current.

F. Acceptable Manufacturers:
   1. Hager: 4500 Series
   2. Von Duprin: 99 Series
   3. Sargent: 80 Series

2.6 CYLINDERS AND KEYING

A. Cylinders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer shall meet the following:
   1. Auxiliary Locks: ANSI/BHMA A156.5
   2. DHI Handbook “Keying systems and nomenclature” (1989)

C. Cylinders:
   1. Manufacturer’s standard tumbler type, BEST seven-pin IC core
   2. Furnish with cams/tailpieces as required for locking device that is being furnished for project.

D. Keying:
   1. Copy of Owners approved keying schedule submitted to Owner and Architect with documentation of which keying conference was held and Owner’s sign-off.
   2. Provide a bitting list to Owner of combinations as established, and expand to twenty-five percent for future use or as directed by Owner.
   3. Keys to be shipped to Owner’s representative, individually tag per keying conference.
   4. Provide visual key control identification on keys.
   5. Provide interchangeable cores with 50 construction cores as required per hardware schedule.

E. Acceptable manufacturers:
   1. Best to match existing

2.7 PUSH/PULL PLATES AND BARS

A. Push/Pull plates and bars of one manufacturer as listed for continuity of design and consideration of warranty.
B. Standards: Manufacturer to be certified by the following:


C. Push plates: .050” thick, square corner and beveled edges with counter sunk screw holes. Width and height as stated in hardware sets.

D. Acceptable Manufacturers:

1. Hager: 30S
2. Rockwood:
3. Trimco:

E. Pull plates: .050” thick, square corner and beveled edges. Width and height as stated in hardware sets, 3/4” diameter pull, with clearance of 2-1/2” from face of door.

F. Acceptable Manufacturers:

1. Hager: H33J
2. Rockwood:
3. Trimco:

G. Push Pull Bar Sets: 1” round bar stock with 2 ½” clearances from face of door. Offset 3”, 90-degree standard. Center to center size should be door width less 1 stile width.

H. Acceptable Manufacturers:

1. Hager: H160D
2. Rockwood:
3. Trimco:

2.8 CLOSERS

A. Closers of one manufacturer as listed for continuity of design and consideration of warranty. Unless otherwise indicated on hardware schedule, comply with manufacturer’s recommendations for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirements, and fire rating.

B. Standards: Manufacturer to be certified and or listed by the following:

1. BHMA Certified ANSI A156.4 Grade 1.
2. ADA Compliant ANSI A117.1.
3. UL/cUL Listed up to 3 hours.
4. UL10C Positive Pressure Rated.
5. UL10B Neutral Pressure Rated.

C. Material and Design:
1. Provide cast iron non-handed bodies with full plastic covers.
2. Closers shall have separate staked adjustable valve screws for latch speed, sweep speed, and backcheck.
3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
4. One-piece seamless steel spring tube sealed in hydraulic fluid.
5. Double heat-treated steel tempered springs.
7. Triple heat-treated steel spindle.
8. Full rack and pinion operation.

D. Mounting:

1. Out-swing doors use surface parallel arm mount closers except where noted on hardware schedule.
2. In-swing doors use surface regular arm mount closers except where noted on hardware schedule.
3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.

E. Size closers in compliance with requirements for accessibility (ADAAG). Comply with following maximum opening force requirements.

1. Interior hinged openings: 5.0 lbs.
2. Fire-rated and exterior openings use minimum opening force allowable by authority having jurisdiction.

F. Fasteners: Provide self-reaming, self-tapping wood and machine screws, and sex nuts and bolts for each closer.

G. Acceptable manufacturers:

1. Hager: 5100 Series
2. LCN: 4040XP Series
3. Sargent: 281 Series

2.9 PROTECTIVE TRIM

A. Protective trim of one manufacturer as listed for continuity of design and consideration of warranty.

B. Size of protection plate: Single doors, size two inches less door width (LDW) on push side of door, and one inch less on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and ½ inch on pull side of door.

1. Kick Plates 10” high or sized to door bottom rail height.
2. Mop Plates 4” high.
C. Standards: Manufacturer shall meet requirements for:

2. UL.

D. Material and Design:

1. 0.050” gage stainless steel.
2. Corners square, polishing lines or dominant direction of surface pattern shall run across door width of plate.
3. Bevel top, bottom and sides uniformly leaving no sharp edges.
4. Countersink holes for screws. Screw holes shall be spaced equidistant eight inches CTC, along a centerline not over 1/2” in from edge around plate. End screws maximum of 0.53” from corners.

E. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufacturer’s UL listing for maximum height and width of protection plate to be used.

F. Acceptable Manufacturers:

1. Hager: 194S
2. Trimco:
3. Burns:

2.10 STOPS AND HOLDERS

A. Stops and holders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible. Door stops and holders mounted in concrete floor or masonry walls have stainless steel machine screws and lead expansion shields.

C. Standards: Manufacturer shall meet requirements for:

1. Auxiliary Hardware: ANSI/BHMA A156.16.

D. Acceptable Manufacturers:

<table>
<thead>
<tr>
<th>Convex</th>
<th>Concave</th>
</tr>
</thead>
<tbody>
<tr>
<td>232W</td>
<td>236W</td>
</tr>
</tbody>
</table>

1. Hager:
2. Rockwood:
3. Burns:

E. Overhead Stops and Holders: Provide overhead stops and holders for doors that open against equipment, casework sidelights and other objects that would make wall stops/holders and floor
stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.

F. Standards: Manufacturer shall be certified by the following:
   1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1.

G. Acceptable Manufacturers:

<table>
<thead>
<tr>
<th>Heavy Duty Surface</th>
<th>Heavy Duty Concealed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hager: 7000 SRF Series</td>
<td>7000 CON Series</td>
</tr>
<tr>
<td>Glynn Johnson: 90 Series</td>
<td>100 Series</td>
</tr>
<tr>
<td>Sargent: 590 Series</td>
<td>690 Series</td>
</tr>
</tbody>
</table>

2.11 ELECTROMAGNETIC HOLDERS

A. Electromagnetic holders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer shall meet requirements for:
   1. ANSI A156.15 Grade 1.
   2. UL/ULC listed.

C. Material and Design:
   1. Provide electromagnetic holders where self-closing fire doors and smoke barrier doors are required to be held open. Electromagnetic holders to be fail safe: when electrical current is interrupted, doors release to close automatically. Holding force 25-40 lbs.

D. Acceptable Manufacturers:
   1. Hager: 380 Series
   2. LCN:
   3. Rixson:

2.12 MODULAR ACCESS CONTROL POWER SUPPLIES

A. Power supplies of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer shall meet requirements for:
   1. UL Listed.

C. Design:
1. Use with modular access control systems.
2. Field selectable filtered and regulated 12 VDC or 24 VDC constant voltage.
3. 1 AMP load capacity
5. Fire alarm input provides simultaneous release of fail-safe locks and holders.
6. Interface relay.
7. LED status indicators provide information regarding AC input, DC output, and battery backup status.
8. Separate inputs for activation switch on entry and egress and ingress side of opening.
9. 5 amp hour battery backup.
10. Input 115 VAC (230 VAC optional).
11. Optional dual 12 VDC or 24 VDC output.

D. Acceptable Manufacturer:
   1. Hager: 2908 x 2-679-0704

2.13 THRESHOLDS

A. Thresholds of one manufacturer as listed for continuity of design and consideration of warranty.

B. Set thresholds for exterior and acoustical openings in full bed of sealant with lead expansion shields and stainless steel machine screws complying with requirements specified in Division 7 Section “Joint Sealants”. Notched in field to fit frame by hardware installer. Refer to Drawings for special details.

C. Standards: Manufacturer to be certified by the following:

D. Acceptable Manufacturers:
   1. Hager: 417S/520S
   2. K.N. Crowder:
   3. Reese:

2.14 DOOR GASKETING AND WEATHERSTRIP

A. Door gasketing and weatherstrip of one manufacturer as listed for continuity of design and consideration of warranty.

B. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide non-corrosive fasteners for exterior applications.

   1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
3. Door bottoms: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
4. Sound Gasketing: Cutting or notching for stop mounted hardware not permitted.
5. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4” beyond width of door.

C. Standards: Manufacturer shall meet requirements for:
   1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22.
   2. BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing.

D. Smoke-Labeled Gasketing: Comply with NFPA 105 listed, labeled, and acceptable to Authorities Having Jurisdiction, for smoke control indicated.
   1. Provide smoke-labeled gasketing on 20 minute rated doors and on smoke rated doors.

E. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.

F. Refer to Section 08 1416 Wood Doors for Category A or Category B. Comply with UBC 7-2 and UL10C positive pressure where frame applied intumescent seals are required.

G. Acceptable Manufacturers:
   1. Perimeter Gasketing:
      a. Hager: 881S
      b. K.N. Crowder:
      c. Reese:
   2. Astragal:
      a. Hager: 835S
      b. K.N. Crowder:
      c. Reese:
   3. Meeting Stile Weatherstrip:
      a. Hager: 802S
      b. K.N. Crowder:
      c. Reese:
   4. Door Bottom Sweeps:
      a. Hager: 750S/770S
      b. K.N. Crowder:
      c. Reese:
5. Overhead Drip Guard
   a. Hager: 810S
   b. K.N. Crowder:
   c. Reese:

2.16 SILENCERS

A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.

B. Standards: Manufacturer shall meet requirements for:
   1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufacturers:
   Hollow Metal Frame
   1. Hager: 307D
   2. Rockwood:
   3. Trimco:

2.17 KEY CABINET

A. Provide key cabinet, surface mounted to wall.

B. Key control system:
   1. Include two sets of key tags, hooks, labels, and envelopes.
   2. Contain system in metal cabinet with baked enamel finish.
   3. Capacity shall be able to hold actual quantities of keys, plus 50 percent.
   4. Provide tools, instruction sheets and accessories required to complete installation.

C. Acceptable Manufacturers:
   1. Lund Equipment
   2. Telkee Incorporated
   3. Key Control

2.18 FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within 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 range of approved samples.

B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.
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 INSTALLATION

A. Install hardware per manufacturer’s instructions and in compliance with:

1. NFPA 80
2. NFPA 105
3. ICC/ANSI A117.1
4. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames
5. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames
6. DHI Publication – Installation Guide for Doors and Hardware
7. UL10C/UBC 7-2
8. Local building code.
9. Approved shop drawings.
10. Approved finish hardware schedule.

B. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

3.3 FIELD QUALITY CONTROL

A. Material supplier to schedule final walk through to inspect hardware installation ten (10) business days before final acceptance of Owner. Material supplier shall provide a written report detailing discrepancies of each opening to General Contractor within seven (7) calendar days of walk through.

3.4 ADJUSTMENT, CLEANING AND DEMONSTRATING

A. Adjustment: Adjust and check each opening to ensure proper operation of each item of finish hardware. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.
B. Cleaning: Clean adjacent surfaces soiled by hardware installation. Clean finish hardware per manufacturer’s instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer’s level of finish quality at no cost to Owner.

C. Demonstration: Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finish hardware to be turned over and explained usage at this meeting.

3.5 PROTECTION

A. Leave manufacturer’s protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacture until Owner accepts project as complete.

3.6 HARDWARE SET SCHEDULE

A. Guide: Door hardware items have been placed in sets which are intended to be a guide of design, grade, quality, function, operation, performance, exposure, and like characteristics of door hardware, and may not be complete. Provide door hardware required to make each set complete and operational.

B. Hardware schedule does not reflect handing, backset, method of fastening, and like characteristics of door hardware and door operation.

C. Review door hardware sets with door types, frames, sizes and details on drawings. Verify suitability and adaptability of items specified in relation to details and surrounding conditions.

3.7 HARDWARE SCHEDULE

**Hardware Sets**

**SET #1**

Doors: HS101

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Code</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>4501 RIM F 36&quot;</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Exit Device Trim</td>
<td>45NL AUG</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Rim Cylinder Housing</td>
<td>3901 SFIC</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM</td>
<td>HA</td>
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<tr>
<td>1 Set Weatherstrip</td>
<td>726 18'</td>
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</tbody>
</table>

**SET #2**

Doors: HS201

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Code</th>
<th>Supplier</th>
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<tbody>
<tr>
<td>3 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D</td>
<td>HA</td>
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<tr>
<td>Hardware</td>
<td>Model/Description</td>
<td>Code</td>
<td>Color</td>
</tr>
<tr>
<td>--------------------------------</td>
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<td>-------</td>
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</tr>
<tr>
<td>Lockset</td>
<td>3880 SECT AUG SFIC7</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>Wall Stop</td>
<td>232W</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>Set Weatherstrip</td>
<td>726 18'</td>
<td>S</td>
<td>HA</td>
</tr>
</tbody>
</table>

**SET #3**

Doors: HS102

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Model/Description</th>
<th>Code</th>
<th>Color</th>
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</thead>
<tbody>
<tr>
<td>Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>Exit Device</td>
<td>4501 RIM 36&quot;</td>
<td>US26D</td>
<td>HA</td>
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<tr>
<td>Exit Device Trim</td>
<td>45NL AUG</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Rim Cylinder Housing</td>
<td>3901 SFIC</td>
<td>US26D</td>
<td>HA</td>
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<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>Set Weatherstrip</td>
<td>881S N 1 x 36&quot; 2 x 94&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
<tr>
<td>Drip Cap</td>
<td>810S 40&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
<tr>
<td>Door Bottom</td>
<td>770S V 36&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
<tr>
<td>Threshold</td>
<td>520S V 36&quot;</td>
<td>MIL</td>
<td>HA</td>
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**SET #4**

Doors: HS202

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<thead>
<tr>
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<th>Model/Description</th>
<th>Code</th>
<th>Color</th>
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<tbody>
<tr>
<td>Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>Lockset</td>
<td>3880 SECT AUG SFIC7</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>Set Weatherstrip</td>
<td>726 18'</td>
<td>S</td>
<td>HA</td>
</tr>
<tr>
<td>Door Sweep</td>
<td>750S N 36&quot;</td>
<td>CLR</td>
<td>HA</td>
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<tr>
<td>Threshold</td>
<td>417S 36&quot;</td>
<td>MIL</td>
<td>HA</td>
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**SET #5**

Doors: H101

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<tr>
<th>Hardware</th>
<th>Model/Description</th>
<th>Code</th>
<th>Color</th>
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<tbody>
<tr>
<td>Continuous Hinge</td>
<td>780-112HD 93&quot; ROUND BACK COVER</td>
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<td>Continuous Hinge</td>
<td>780-112HD 93&quot; RETW10 ROUND BACK COVER</td>
<td>CLR</td>
<td>HA</td>
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<tr>
<td>Exit Device</td>
<td>3347A-EO</td>
<td>US26D</td>
<td>VO</td>
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<tr>
<td>Exit Device</td>
<td>QEL 3347A-L x 360-L 07</td>
<td>US26D</td>
<td>VO</td>
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<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>Power Supply</td>
<td>PS914</td>
<td>VO</td>
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<tr>
<td>Threshold</td>
<td>520S V 72&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
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</table>
NOTE: DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

SET #6

<table>
<thead>
<tr>
<th>Doors: H102</th>
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<tbody>
<tr>
<td>1 Continuous Hinge</td>
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<tr>
<td>1 Continuous Hinge</td>
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<tr>
<td>1 Exit Device</td>
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<td>1 Exit Device</td>
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<tr>
<td>1 Cylinder Core</td>
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<tr>
<td>1 Mortise Cylinder Housing</td>
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<tr>
<td>2 Closer</td>
</tr>
<tr>
<td>1 Power Supply</td>
</tr>
<tr>
<td>1 Threshold</td>
</tr>
</tbody>
</table>

NOTE: DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

SET #7

<table>
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<th>Doors: H103A</th>
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<tbody>
<tr>
<td>6 Hinge</td>
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<tr>
<td>1 Set Auto Flush Bolts</td>
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<td>1 Lockset</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
</tr>
<tr>
<td>1 Coordinating Device</td>
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<tr>
<td>2 Mounting Bracket</td>
</tr>
</tbody>
</table>
2 Closer 5100 5955-HDCS ALM HA
1 Dust Proof Strike 280X US26D HA
1 Astragal 835S 86" USP HA
1 Set Weatherstrip 726 336" S HA

SET #8

Doors: H104

3 Hinge BB1191 4 1/2 X 4 1/2 US32D HA
1 Lockset 3870 SECT AUG SFIC7 US26D HA
1 Cylinder Core 3982-C US26D HA
1 Protection Plate 194S 10" x 34" CSK US32D HA
1 Wall Stop 232W US32D HA
1 Set Weatherstrip 726 x LAR S HA

SET #9

Doors: H105, H106, H107, H117, H118, H120, H121, H152

3 Hinge BB1191 4 1/2 X 4 1/2 US32D HA
1 Lockset 3850 SECT AUG SFIC7 US26D HA
1 Cylinder Core 3982-C US26D HA
1 Protection Plate 194S 10" x 34" CSK US32D HA
1 Wall Stop 232W US32D HA
1 Set Weatherstrip 726 18' S HA

SET #10

Doors: H108, H109

3 Hinge BB1191 4 1/2 X 4 1/2 NRP US32D HA
1 Lockset 3857 SECT AUG SFIC7 US26D HA
2 Cylinder Core 3982-C US26D HA
1 Closer 5100 ALM HA
1 Protection Plate 194S 10" x 34" CSK US32D HA
1 Wall Stop 232W US32D HA
1 Set Weatherstrip 726 18' S HA

SET #11

Doors: H113, H114

3 Hinge BB1191 4 1/2 X 4 1/2 US32D HA
1 Passage Set 3810 SECT AUG US26D HA
1 Closer 5100 ALM HA
1 Protection Plate 194S 10" x 34" CSK US32D HA
1 Protection Plate 194S 4" x 35" CSK US32D HA
1 Wall Stop 232W US32D HA
<table>
<thead>
<tr>
<th>Set #</th>
<th>Door Hardware</th>
<th>Color</th>
<th>Finish</th>
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<tbody>
<tr>
<td>#12</td>
<td>Door Silencer</td>
<td>307D</td>
<td>GREY</td>
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<td>US32D</td>
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<td>Lockset</td>
<td>3880 SECT AUG SFIC7</td>
<td>US26D</td>
</tr>
<tr>
<td></td>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
</tr>
<tr>
<td></td>
<td>Closer</td>
<td>5100</td>
<td>ALM</td>
</tr>
<tr>
<td></td>
<td>Protection Plate</td>
<td>194S 10&quot; x 34&quot; CSK</td>
<td>US32D</td>
</tr>
<tr>
<td></td>
<td>Wall Stop</td>
<td>232W</td>
<td>US32D</td>
</tr>
<tr>
<td></td>
<td>Set Weatherstrip</td>
<td>726 18'</td>
<td>S</td>
</tr>
<tr>
<td>#13</td>
<td>NOTE: NOT USED</td>
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<td>#14</td>
<td>Doors: H116</td>
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<td>Hinge</td>
<td>BB1191 4 1/2 X 4 1/2</td>
<td>US32D</td>
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<tr>
<td></td>
<td>Lockset</td>
<td>3850 SECT AUG SFIC7</td>
<td>US26D</td>
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<td></td>
<td>Cylinder Core</td>
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<td>US26D</td>
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<td>Closer</td>
<td>5100</td>
<td>ALM</td>
</tr>
<tr>
<td></td>
<td>Protection Plate</td>
<td>194S 10&quot; x 34&quot; CSK</td>
<td>US32D</td>
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<tr>
<td></td>
<td>Wall Stop</td>
<td>232W</td>
<td>US32D</td>
</tr>
<tr>
<td></td>
<td>Set Weatherstrip</td>
<td>726 18'</td>
<td>S</td>
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<tr>
<td>#15</td>
<td>Doors: H119, H136, H137A, H137B</td>
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<td></td>
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<td>BB1191 4 1/2 X 4 1/2</td>
<td>US32D</td>
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<tr>
<td></td>
<td>Lockset</td>
<td>3870 SECT AUG SFIC7</td>
<td>US26D</td>
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<td></td>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
</tr>
<tr>
<td></td>
<td>Closer</td>
<td>5100</td>
<td>ALM</td>
</tr>
<tr>
<td></td>
<td>Protection Plate</td>
<td>194S 10&quot; x 34&quot; CSK</td>
<td>US32D</td>
</tr>
<tr>
<td></td>
<td>Wall Stop</td>
<td>232W</td>
<td>US32D</td>
</tr>
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<td>Door Silencer</td>
<td>307D</td>
<td>GREY</td>
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<tr>
<td>#16</td>
<td>Doors: H125A, H135A</td>
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<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D</td>
</tr>
<tr>
<td></td>
<td>Exit Device</td>
<td>4501 RIM 36&quot;</td>
<td>US26D</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------</td>
<td></td>
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</tr>
<tr>
<td>1 Exit Device Trim</td>
<td>45CE AUG</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
<td>US26D</td>
<td>HA</td>
</tr>
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<td>1 Closer</td>
<td>5100 5955-HDCC</td>
<td>ALM</td>
<td>HA</td>
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<tr>
<td>1 Set Weatherstrip</td>
<td>726 18'</td>
<td>S</td>
<td>HA</td>
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**NOTE:** HARDWARE BY OVERHEAD DOOR SUPPLIER

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<th>Doors: H125C</th>
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<td>BB1191 4 1/2 X 4 1/2 NRP</td>
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<tr>
<td>2 Exit Device</td>
<td>4501 F CVR 36&quot; X 96&quot;</td>
</tr>
<tr>
<td>1 Exit Device Trim</td>
<td>45CE AUG</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
</tr>
<tr>
<td>1 Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
</tr>
<tr>
<td>2 Closer</td>
<td>5100 5955-HDCC</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 21'</td>
</tr>
<tr>
<td>2 Brush Weatherstrip</td>
<td>802S B 86&quot;</td>
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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>3 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
</tr>
<tr>
<td>1 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 ETW-6</td>
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<tr>
<td>1 Exit Device</td>
<td>4501 RIM 36&quot;</td>
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<td>1 Exit Device Trim</td>
<td>45CE AUG ET EU</td>
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<tr>
<td>1 Cylinder Core</td>
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<tr>
<td>1 Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
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<tr>
<td>1 Closer</td>
<td>5100 5955-HDCC</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>2908</td>
</tr>
<tr>
<td>1 Access Control Module</td>
<td>2-679-0704</td>
</tr>
<tr>
<td>1 Drip Cap</td>
<td>810S 40&quot;</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>881S N 1 x 36&quot; 2 x 94&quot;</td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>770S V 36&quot;</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>520S V 36&quot;</td>
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</tbody>
</table>

Card Reader by Security Contractor

**Description of operation:**
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

**SET #20**

Doors: H127

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>3 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP US32D HA</td>
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<tr>
<td>1 Lockset</td>
<td>3880 SECT AUG SFIC7 US26D HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C US26D HA</td>
</tr>
<tr>
<td>1 Closer</td>
<td>5100 5955-HDCS ALM HA</td>
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<td>1 Set Weatherstrip</td>
<td>726 19’ S HA</td>
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**SET #21**

Doors: H128, H166

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<th>Description</th>
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<tbody>
<tr>
<td>1 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 ETW-6 US32D HA</td>
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<td>2 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 US32D HA</td>
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<tr>
<td>1 Electrified Lockset</td>
<td>3880EU SECT AUG SFIC7 US26D HA</td>
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<td>1 Cylinder Core</td>
<td>3982-C US26D HA</td>
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<td>1 Closer</td>
<td>5100 US26D HA</td>
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<tr>
<td>1 Wall Stop</td>
<td>232W US32D HA</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>2908 HA</td>
</tr>
<tr>
<td>1 Access Control Module</td>
<td>2-679-0704 HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 18’ S HA</td>
</tr>
</tbody>
</table>

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

**SET #22**

Doors: H130B, H139C

<table>
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<th>Description</th>
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<tbody>
<tr>
<td>6 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP US32D HA</td>
</tr>
<tr>
<td>2 Exit Device</td>
<td>4501 F CVR 36” X 96” US26D HA</td>
</tr>
<tr>
<td>1 Exit Device Trim</td>
<td>45CE AUG US26D HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C US26D HA</td>
</tr>
<tr>
<td>1 Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8” US26D HA</td>
</tr>
<tr>
<td>2 Closer</td>
<td>5100 5955-HDCS ALM HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 21’ S HA</td>
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<tr>
<td>2 Brush Weatherstrip</td>
<td>802S B 86” MIL HA</td>
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<tr>
<td>2 Door Sweep</td>
<td>750S N 36” CLR HA</td>
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SET #23

Doors: H131, H133

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<th>Item</th>
<th>Model/Spec</th>
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<td>1 Push Plate</td>
<td>30S 6 x 16</td>
<td>US32D</td>
<td>HA</td>
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<tr>
<td>1 Door Pull</td>
<td>H33J 4 x 16</td>
<td>US32D</td>
<td>HA</td>
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<tr>
<td>1 Closer</td>
<td>5100</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>194S 10&quot; x 34&quot; CSK</td>
<td>US32D</td>
<td>HA</td>
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<tr>
<td>1 Protection Plate</td>
<td>194S 4&quot; x 35&quot; CSK</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>232W</td>
<td>US32D</td>
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<tr>
<td>3 Door Silencer</td>
<td>307D</td>
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SET #24

Doors: H151, H153B

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Spec</th>
<th>Finish</th>
<th>Notes</th>
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<tbody>
<tr>
<td>3 Hinge</td>
<td>BB1191 4 1/2 x 4 1/2</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Lockset</td>
<td>3870 SECT AUG SFIC7</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Closer</td>
<td>5100</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>232W</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 18'</td>
<td>S</td>
<td>HA</td>
</tr>
<tr>
<td>1 Door Sweep</td>
<td>750S N 36&quot;</td>
<td>CLR</td>
<td>HA</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>417S 36&quot;</td>
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SET #25

Doors: H153A

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<thead>
<tr>
<th>Item</th>
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<th>Notes</th>
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<tr>
<td>3 Hinge</td>
<td>BB1199 4 1/2 x 4 1/2</td>
<td>US32D</td>
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<td>1 Lockset</td>
<td>3870 SECT AUG SFIC7</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Closer</td>
<td>5100</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>232W</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 19'</td>
<td>S</td>
<td>HA</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>417S 48&quot;</td>
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SET #26

Doors: H154A

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<th>Item</th>
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<th>Notes</th>
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<tr>
<td>6 Hinge</td>
<td>BB1191 4 1/2 x 4 1/2</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Set Auto Flush Bolts</td>
<td>292D</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Lockset</td>
<td>3870 SECT AUG SFIC7</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
</tbody>
</table>
1 Coordinating Device  297D 72"  BLACK  HA  
2 Closer  5100 TRK NHOTA  ALM  HA  
1 Dust Proof Strike  280X  US26D  HA  
1 Astragal  835S 86"  USP  HA  
1 Set Weatherstrip  726 336"  S  HA  

**SET #27**

Doors: H154B

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<tr>
<td>Hinge</td>
<td>BB1191 4 1/2 X 4 1/2</td>
<td>US32D  HA</td>
</tr>
<tr>
<td>Lockset</td>
<td>3870 SECT AUG SFIC7</td>
<td>US26D  HA</td>
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<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D  HA</td>
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<tr>
<td>Closer</td>
<td>5100 TRK NHOTA</td>
<td>ALM  HA</td>
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<tr>
<td>Set Weatherstrip</td>
<td>726 18'</td>
<td>S  HA</td>
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**SET #28**

Doors: H155A

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<td>Hinge</td>
<td>BB1191 4 1/2 X 4 1/2</td>
<td>US32D  HA</td>
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<tr>
<td>Exit Device</td>
<td>4501 RIM F 36&quot;</td>
<td>US26D  HA</td>
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<tr>
<td>Exit Device Trim</td>
<td>45CE AUG</td>
<td>US26D  HA</td>
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<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D  HA</td>
</tr>
<tr>
<td>Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
<td>US26D  HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100</td>
<td>ALM  HA</td>
</tr>
<tr>
<td>Wall Stop</td>
<td>232W</td>
<td>US32D  HA</td>
</tr>
<tr>
<td>Set Weatherstrip</td>
<td>726 18'</td>
<td>S  HA</td>
</tr>
<tr>
<td>Door Sweep</td>
<td>750S N 36&quot;</td>
<td>CLR  HA</td>
</tr>
<tr>
<td>Threshold</td>
<td>417S 36&quot;</td>
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**SET #29**

Doors: H167

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<tr>
<td>Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D  HA</td>
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<td>Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 ETW-6</td>
<td>US32D  HA</td>
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<td>Exit Device</td>
<td>4501 CVR 36&quot; X 96&quot;</td>
<td>US26D  HA</td>
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<tr>
<td>Exit Device Trim</td>
<td>45CE AUG ET EU</td>
<td>US26D  HA</td>
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<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D  HA</td>
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<tr>
<td>Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
<td>US26D  HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM  HA</td>
</tr>
<tr>
<td>Power Supply</td>
<td>2908</td>
<td>HA</td>
</tr>
<tr>
<td>Access Control Module</td>
<td>2-679-0704</td>
<td>HA</td>
</tr>
<tr>
<td>Drip Cap</td>
<td>810S 76&quot;</td>
<td>MIL  HA</td>
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<tr>
<td>Set Weatherstrip</td>
<td>881S N 1 x 72&quot; 2 x 94&quot;</td>
<td>MIL  HA</td>
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<tr>
<td>Door Sweep</td>
<td>756S V 94&quot;</td>
<td>MIL  HA</td>
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<tr>
<td>Door Bottom</td>
<td>770S V 36&quot;</td>
<td>MIL  HA</td>
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<td>SET #30</td>
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<td><strong>Doors:</strong> H168</td>
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<thead>
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<tbody>
<tr>
<td>7 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP US32D HA</td>
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<tr>
<td>1 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 ETW-6 US32D HA</td>
</tr>
<tr>
<td>1 Set Auto Flush Bolts</td>
<td>292D US32D HA</td>
</tr>
<tr>
<td>1 Electrified Lockset</td>
<td>3880EU SECT AUG SFIC7 US26D HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C US26D HA</td>
</tr>
<tr>
<td>1 Coordinating Device</td>
<td>297D 72&quot; BLACK HA</td>
</tr>
<tr>
<td>2 Mounting Bracket</td>
<td>297N/297M BLACK HA</td>
</tr>
<tr>
<td>2 Closer</td>
<td>5100 5955-HDCS ALM HA</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>2908 HA</td>
</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>280X US26D HA</td>
</tr>
<tr>
<td>1 Access Control Module</td>
<td>2-679-0704 HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>881S N 1 x 72&quot; 2 x 94&quot; MIL HA</td>
</tr>
<tr>
<td>1 Drip Cap</td>
<td>810S 76&quot; MIL HA</td>
</tr>
<tr>
<td>1 Astragal</td>
<td>835S 94&quot; USP HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 96&quot; S HA</td>
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<tr>
<td>2 Door Bottom</td>
<td>770S V 36&quot; MIL HA</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>520S V 72&quot; MIL HA</td>
</tr>
</tbody>
</table>

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

SET #31

<table>
<thead>
<tr>
<th>SET #31</th>
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<tr>
<td><strong>Doors:</strong> H169A</td>
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<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>3 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP US32D HA</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>4501 RIM F 36&quot; US26D HA</td>
</tr>
<tr>
<td>1 Exit Device Trim</td>
<td>45CE AUG US26D HA</td>
</tr>
<tr>
<td>Description</td>
<td>Code</td>
</tr>
<tr>
<td>-------------------------------------</td>
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</tr>
<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
</tr>
<tr>
<td>Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
</tr>
<tr>
<td>Set Weatherstrip</td>
<td>726 18'</td>
</tr>
<tr>
<td>Door Sweep</td>
<td>750S N 36&quot;</td>
</tr>
<tr>
<td>Threshold</td>
<td>417S 36&quot;</td>
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**SET #32**

Doors: H201A

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D HA</td>
</tr>
<tr>
<td>Lockset</td>
<td>3866 SECT SFIC7 AUG</td>
<td>US26D HA</td>
</tr>
<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM HA</td>
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<tr>
<td>Drip Cap</td>
<td>810S 40&quot;</td>
<td>MIL HA</td>
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<tr>
<td>Set Weatherstrip</td>
<td>881S N 1 x 36&quot; 2 x 86&quot;</td>
<td>MIL HA</td>
</tr>
<tr>
<td>Door Bottom</td>
<td>770S V 36&quot;</td>
<td>MIL HA</td>
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<tr>
<td>Threshold</td>
<td>520S V 36&quot;</td>
<td>MIL HA</td>
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**SET #33**

Doors: S101, S103

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<th>Description</th>
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<tr>
<td>Continuous Hinge</td>
<td>780-112HD 93&quot; RETW10 ROUND BACK COVER</td>
<td>CLR HA</td>
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<tr>
<td>Continuous Hinge</td>
<td>780-112HD 93&quot; ROUND BACK COVER</td>
<td>CLR HA</td>
</tr>
<tr>
<td>Exit Device</td>
<td>3347A-EO</td>
<td>US26D VO</td>
</tr>
<tr>
<td>Exit Device</td>
<td>QEL 3347A-L x 360-L 07</td>
<td>US26D VO</td>
</tr>
<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D HA</td>
</tr>
<tr>
<td>Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
<td>US26D HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM HA</td>
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<tr>
<td>Power Supply</td>
<td>PS914</td>
<td>VO</td>
</tr>
<tr>
<td>Threshold</td>
<td>520S V 72&quot;</td>
<td>MIL HA</td>
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**NOTE:** DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

**SET #34**
Doors: S102

1 Continuous Hinge 780-112HD 93” RETW10 ROUND CLR HA
BACK COVER
1 Continuous Hinge 780-112HD 93” ROUND BACK CLR HA
COVER
1 Exit Device 3347A-EO US26D VO
1 Exit Device QEL 3347A-L x 360-L 07 US26D VO
1 Cylinder Core 3982-C US26D HA
1 Mortise Cylinder Housing 3902 SFIC 1 5/8” US26D HA
2 Closer 5100 5955-HDCS US32D HA
1 Power Supply PS914 VO
1 Threshold 417S 72” MIL HA

NOTE: DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

SET #35

Doors: S105

1 Continuous Hinge 780-112HD 83” ROUND BACK COVER CLR HA
1 Deadlock MS1850S 628 AD
2 Cylinder Core 3982-C US26D HA
1 Mortise Cylinder Housing 3902 SFIC 1 5/8” 3972 CAM US26D HA
1 Closer 5100 ALM HA
1 Wall Stop 232W US32D HA
1 Threshold 417S 36” MIL HA

NOTE: DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

SET #36

Doors: S106

3 Hinge BB1191 4 1/2 X 4 1/2 US32D HA
1 Lockset 3850 SECT AUG SFIC7 US26D HA
1 Cylinder Core 3982-C US26D HA
1 Protection Plate 194S 10” x 34” CSK US32D HA
1 Wall Stop 232W US32D HA
<table>
<thead>
<tr>
<th>SET #37</th>
<th>Doors: S107, S111</th>
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</thead>
<tbody>
<tr>
<td>3 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP US32D HA</td>
</tr>
<tr>
<td>1 Lockset</td>
<td>3850 SECT AUG SFIC7 US26D HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C US26D HA</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>194S 10&quot; x 34&quot; CSK US32D HA</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>232W US32D HA</td>
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<tr>
<td>1 Set Weatherstrip</td>
<td>726 18' S HA</td>
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<table>
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<tr>
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<th>Doors: S108, S110</th>
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<tr>
<td>3 Hinge</td>
<td>BB1199 4 1/2 X 4 1/2 US32D HA</td>
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<td>1 Push Plate</td>
<td>30S 6 X 16 US32D HA</td>
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<td>1 Door Pull</td>
<td>H 33J 4 X 16 US32D HA</td>
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<tr>
<td>1 Protection Plate</td>
<td>194S 10&quot; x 34&quot; CSK US32D HA</td>
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<td>1 Protection Plate</td>
<td>194S 4&quot; x 35&quot; CSK US32D HA</td>
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<tr>
<td>1 Wall Stop</td>
<td>232W US32D HA</td>
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<td>3 Door Silencer</td>
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<td>1 Lockset</td>
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<td>1 Cylinder Core</td>
<td>3982-C US26D HA</td>
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<tr>
<td>1 Overhead Stop</td>
<td>7016 SRF SZ1 US32D HA</td>
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<tr>
<td>3 Door Silencer</td>
<td>307D GREY HA</td>
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<td>1 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 ETW-6 US32D HA</td>
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<tr>
<td>1 Electrified Lockset</td>
<td>3880EU SECT AUG SFIC7 US26D HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C US26D HA</td>
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<td>1 Closer</td>
<td>5100 5955-HDCS ALM HA</td>
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<td>Set #41</td>
<td>Doors: S115, S117, S118</td>
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<td>1 Lockset</td>
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<tr>
<td>1 Closer</td>
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</tr>
<tr>
<td>1 Protection Plate</td>
<td>194S 10&quot; x 34&quot; CSK</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>232W</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 18&quot;</td>
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<tr>
<td>1 Door Sweep</td>
<td>750S N 36&quot;</td>
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<td>1 Threshold</td>
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<td>LKM-7003X10</td>
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<td>US26D</td>
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<td>1 Rim Cylinder Housing</td>
<td>3901 SFIC</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
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<tr>
<td>1 Closer</td>
<td>5100 5955-HDCS</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>194S 10&quot; x 34&quot; CSK</td>
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<td>1 Magnetic Switch</td>
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<td>BB1191 4 1/2 X 4 1/2 ETW-6</td>
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<td>2 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2</td>
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<tr>
<td>1 Electrified Lockset</td>
<td>3880EU SECT AUG SFIC7</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
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Card Reader by Security Contractor

Description of operation:
- Door is normally closed and secure, entry by key leaves lever in locked position
- Upon proper credential validation, entry is permitted
- Door relocks upon closing
- Free egress all times
- Door remains closed and locked upon power failure or fire alarm activation (fail secure)
Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

SET #44

Doors: S123

<table>
<thead>
<tr>
<th>Item</th>
<th>Model/Description</th>
<th>Finish Code</th>
<th>Hardware Type</th>
</tr>
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<tbody>
<tr>
<td>1 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Set Auto Flush Bolts</td>
<td>292D</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Lockset</td>
<td>3881 SECT AUG SFIC7</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>2 Overhead Stop</td>
<td>7016 SRF SZ1</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>280X</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Astragal</td>
<td>835S 86&quot;</td>
<td>USP</td>
<td>HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 336&quot;</td>
<td>S</td>
<td>HA</td>
</tr>
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SET #45

Doors: S124

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<tr>
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<th>Hardware Type</th>
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<tbody>
<tr>
<td>1 Continuous Hinge</td>
<td>780-112HD 85&quot; RETW10 ROUND BACK COVER</td>
<td>CLR</td>
<td>HA</td>
</tr>
<tr>
<td>1 Continous Hinge</td>
<td>780-112HD 85&quot; ROUND BACK COVER</td>
<td>CLR</td>
<td>HA</td>
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<tr>
<td>1 Exit Device</td>
<td>3347A-EO</td>
<td>US26D</td>
<td>VO</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>QEL 3347A-L x 360-L 07</td>
<td>US26D</td>
<td>VO</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>2 Closer</td>
<td>5100 5955-HDSCs</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>PS914</td>
<td>VO</td>
<td></td>
</tr>
<tr>
<td>1 Threshold</td>
<td>417S 72&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
</tbody>
</table>

NOTE: DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

Card Reader by Security Contractor
Description of operation:
- Door is normally closed and secure, entry by key leaves lever in locked position
- Upon proper credential validation, entry is permitted
- Door relocks upon closing
- Free egress all times
- Door remains closed and locked upon power failure or fire alarm activation (fail secure)

**SET #46**

Doors: H130A

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Model Numbers</th>
<th>Notes</th>
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<tbody>
<tr>
<td>2 Continuous Hinge</td>
<td>780-112HD 93&quot; ROUND</td>
<td>CLR</td>
<td>HA</td>
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<tr>
<td>Back Cover</td>
<td></td>
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<tr>
<td>1 Exit Device</td>
<td>3347A-EO</td>
<td>US26D</td>
<td>VO</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>3347A-L x 360-L 07</td>
<td>US26D</td>
<td>VO</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>2 Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>2 Drop Plate</td>
<td>5110</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>2 Blade Stop Spacer</td>
<td>5113</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>520S V 72&quot;</td>
<td>MIL</td>
<td>HA</td>
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**NOTE:** DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

**SET #47**

Doors: S126

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<thead>
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<th>Item Description</th>
<th>Manufacturer</th>
<th>Model Numbers</th>
<th>Notes</th>
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<tbody>
<tr>
<td>5 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 ETW-6</td>
<td>US32D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Set Auto Flush Bolts</td>
<td>292D</td>
<td>US32D</td>
<td>HA</td>
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<tr>
<td>1 Electrified Lockset</td>
<td>3880EU SECT AUG SFIC7</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Coordinating Device</td>
<td>297D 72&quot;</td>
<td>BLACK</td>
<td>HA</td>
</tr>
<tr>
<td>2 Mounting Bracket</td>
<td>297N/297M</td>
<td>BLACK</td>
<td>HA</td>
</tr>
<tr>
<td>2 Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>2908</td>
<td>HA</td>
<td></td>
</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>280X</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>1 Access Control Module</td>
<td>2-679-0704</td>
<td>HA</td>
<td></td>
</tr>
<tr>
<td>1 Astragal</td>
<td>835S 86&quot;</td>
<td>USP</td>
<td>HA</td>
</tr>
<tr>
<td>1 Drip Cap</td>
<td>810S 76&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>881S N 1 x 72&quot; 2 x 86&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 86&quot;</td>
<td>S</td>
<td>HA</td>
</tr>
<tr>
<td>2 Door Bottom</td>
<td>770S V 36&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>520S V 72&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
</tbody>
</table>

Card Reader by Security Contractor
Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

SET #48

Doors: S127A

3 Hinge BB1191 4 1/2 X 4 1/2 NRP US32D HA
1 Lockset 3880 SECT AUG SFIC7 US26D HA
1 Cylinder Core 3982-C US26D HA
1 Closer 5100 5955-HDCS ALM HA
1 Set Weatherstrip 726 18' S HA
1 Door Sweep 750S N 36" CLR HA
1 Threshold 417S 36" MIL HA

SET #49

Doors: S127C

NOTE: HARDWARE BY OVERHEAD DOOR SUPPLIER

SET #50

Doors: S128

1 Hinge BB1191 4 1/2 X 4 1/2 ETW-6 US32D HA
2 Hinge BB1191 4 1/2 X 4 1/2 US32D HA
1 Electrified Lockset 3880EU SECT AUG SFIC7 US26D HA
1 Cylinder Core 3982-C US26D HA
1 Closer 5100 5955-HDCS ALM HA
1 Power Supply 2908 HA
1 Access Control Module 2-679-0704 HA
1 Set Weatherstrip 726 18' S HA

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

SET #51
### Doors: H103B

<table>
<thead>
<tr>
<th>Item Type</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Finish</th>
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</thead>
<tbody>
<tr>
<td>Continuous Hinge</td>
<td>780-112HD 93&quot; ROUND BACK COVER</td>
<td>CLR</td>
<td>HA</td>
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<tr>
<td>Continuous Hinge</td>
<td>780-112HD 93&quot; RETW10 ROUND BACK COVER</td>
<td>CLR</td>
<td>HA</td>
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<tr>
<td>Exit Device</td>
<td>3347A-EO</td>
<td>US26D</td>
<td>VO</td>
</tr>
<tr>
<td>Exit Device</td>
<td>QEL 3347A-L x 360-L 07</td>
<td>US26D</td>
<td>VO</td>
</tr>
<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Mortise Cylinder Housing</td>
<td>3902 SFIC 1 5/8&quot;</td>
<td>US26D</td>
<td>HA</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>Drop Plate</td>
<td>5110</td>
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<td>HA</td>
</tr>
<tr>
<td>Blade Stop Spacer</td>
<td>5113</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>Power Supply</td>
<td>2908</td>
<td>HA</td>
<td></td>
</tr>
<tr>
<td>Access Control Module</td>
<td>2-679-0704</td>
<td>HA</td>
<td></td>
</tr>
<tr>
<td>Threshold</td>
<td>520S V 72&quot;</td>
<td>MIL</td>
<td>HA</td>
</tr>
</tbody>
</table>

NOTE: DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)

### SET #52

<table>
<thead>
<tr>
<th>Item Type</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Hinge</td>
<td>780-112HD 93&quot; ROUND BACK COVER</td>
<td>CLR</td>
<td>HA</td>
</tr>
<tr>
<td>Push/Pull Set</td>
<td>160D</td>
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<td>Closer</td>
<td>5100 TRK NHOTA</td>
<td>ALM</td>
<td>HA</td>
</tr>
<tr>
<td>Threshold</td>
<td>417S 72&quot;</td>
<td>MIL</td>
<td>HA</td>
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</table>

NOTE: DOOR BOTTOM, WEATHERSTRIP BY DOOR SUPPLIER

### SET #53

<table>
<thead>
<tr>
<th>Item Type</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Hinge</td>
<td>780-112HD 93&quot; ROUND BACK COVER</td>
<td>CLR</td>
<td>HA</td>
</tr>
</tbody>
</table>

NOTE: CYLINDER(S) AS REQUIRED. REMAINDER OF HARDWARE BY DOOR SUPPLIER

### SET #54
Doors: H201B, H202

6 Hinge | BB1191 4 1/2 X 4 1/2 NRP | US32D | HA
1 Set Auto Flush Bolts | 292D | US32D | HA
1 Lockset | 3866 SECT SFIC7 AUG | US26D | HA
2 Cylinder Core | 3982-C | US26D | HA
2 Overhead Holder | 7017 SRF | US32D | HA
1 Dust Proof Strike | 280X | US26D | HA
1 Astragal | 835S 86" | USP | HA
1 Set Weatherstrip | 726 336" | S | HA
2 Door Bottom | 770S V 36" | MIL | HA
1 Threshold | 417S 72" | MIL | HA

SET #55

Doors: HS301

3 Hinge | BB1191 4 1/2 X 4 1/2 NRP | US32D | HA
1 Lockset | 3880 SECT AUG SFIC7 | US26D | HA
1 Closer | 5100 | ALM | HA
1 Wall Stop | 232W | US32D | HA
1 Set Weatherstrip | 726 18' | S | HA
1 Door Sweep | 750S N 36" | CLR | HA
1 Threshold | 417S 36" | MIL | HA

SET #56

Doors: S121

2 Hinge | BB1191 4 1/2 X 4 1/2 NRP | US32D | HA
1 Hinge | BB1191 4 1/2 X 4 1/2 ETW-6 | US32D | HA
1 Electrified Lockset | 3880EU SECT AUG SFIC7 | US26D | HA
1 Cylinder Core | 3982-C | US26D | HA
1 Closer | 5100 | ALM | HA
1 Wall Stop | 232W | US32D | HA
1 Power Supply | 2908 | HA
1 Access Control Module | 2-679-0704 | HA
1 Set Weatherstrip | 726 18' | S | HA

Card Reader by Security Contractor

Description of operation:
Door is normally closed and secure, entry by key leaves lever in locked position
Upon proper credential validation, entry is permitted
Door relocks upon closing
Free egress all times
Door remains closed and locked upon power failure or fire alarm activation (fail secure)
### SET #57

Doors: S127B

<table>
<thead>
<tr>
<th>Item</th>
<th>Code/Description</th>
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</thead>
<tbody>
<tr>
<td>3 Hinge</td>
<td>BB1191 4 1/2 X 4 1/2 NRP</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>4501 RIM 36&quot;</td>
</tr>
<tr>
<td>1 Exit Device Trim</td>
<td>45NL AUG</td>
</tr>
<tr>
<td>1 Rim Cylinder Housing</td>
<td>3901 SFIC</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
</tr>
<tr>
<td>1 Closer</td>
<td>5100 5955-HDCS</td>
</tr>
<tr>
<td>1 Drip Cap</td>
<td>810S x LAR</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>881S N 1 x 36&quot; 2 x 86&quot;</td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>770S V 36&quot;</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>520S V 36&quot;</td>
</tr>
</tbody>
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### SET #58

Doors: S129

<table>
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<tbody>
<tr>
<td>6 Hinge</td>
<td>BB1199 4 1/2 X 4 1/2 NRP</td>
</tr>
<tr>
<td>1 Set Auto Flush Bolts</td>
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</tr>
<tr>
<td>1 Lockset</td>
<td>3880 SECT AUG SFIC7</td>
</tr>
<tr>
<td>1 Cylinder Core</td>
<td>3982-C</td>
</tr>
<tr>
<td>2 Mounting Bracket</td>
<td>297N/297M</td>
</tr>
<tr>
<td>1 Coordinator</td>
<td>297D 96&quot;</td>
</tr>
<tr>
<td>2 Closer</td>
<td>5100 5955-HDCS</td>
</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>280X</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>726 336&quot;</td>
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<td>1 Astragal</td>
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### SET #59

Doors: HS401

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<tr>
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<tr>
<td>1 Lockset</td>
<td>3866 SECT SFIC7 AUG</td>
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<tr>
<td>2 Cylinder Core</td>
<td>3982-C</td>
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<tr>
<td>1 Closer</td>
<td>5100 5955-HDCS</td>
</tr>
<tr>
<td>1 Drip Cap</td>
<td>810S 40&quot;</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>881S N 1 x 36&quot; 2 x 86&quot;</td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>770S V 36&quot;</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>520S V 36&quot;</td>
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### SET #60

Doors: P101

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<tr>
<td>8 Hinge</td>
<td>BB1199 4 1/2 X 4 1/2 NRP</td>
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<tr>
<td>1 Set Auto Flush Bolts</td>
<td>292D</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Lockset</td>
<td>3881 SECT AUG SFIC7</td>
</tr>
<tr>
<td>Cylinder Core</td>
<td>3982-C</td>
</tr>
<tr>
<td>Mounting Bracket</td>
<td>297N/297M</td>
</tr>
<tr>
<td>Coordinator</td>
<td>297D 96&quot;</td>
</tr>
<tr>
<td>Closer</td>
<td>5100 5955-HDCS</td>
</tr>
<tr>
<td>Dust Proof Strike</td>
<td>280X</td>
</tr>
<tr>
<td>Set Weatherstrip</td>
<td>881S N 1 x 96&quot; 2 x 94&quot;</td>
</tr>
<tr>
<td>Drip Cap</td>
<td>810S 100&quot;</td>
</tr>
<tr>
<td>Astragal</td>
<td>835S 94&quot;</td>
</tr>
<tr>
<td>Set Weatherstrip</td>
<td>726 96&quot;</td>
</tr>
<tr>
<td>Door Bottom</td>
<td>770S V x LAR</td>
</tr>
<tr>
<td>Threshold</td>
<td>520S V 96&quot;</td>
</tr>
</tbody>
</table>

END OF SECTION 08 71 00
SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.
2. Glazed curtain walls.
3. Glazed entrances.
4. Interior borrowed lites.

1.2 DEFINITIONS

A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.

D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.

1.3 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
B. Delegated Comprehensive Design Assembly: Design exterior aluminum framing and glazing systems components as a comprehensive assembly, including comprehensive engineering analysis according to ASTM Standards listed and the ICC’s 2012 International Building Code using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
4. Other Design Loads: Framing members and connections shall be designed to withstand blast loading resultant from designated weapon and standoff distances in accordance with UFC 4-010-01.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
3. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.

C. Glass Samples: For each type of the following products; 12 inches square.

1. Tinted glass.
2. Insulating glass.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. 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.
F. All test results shall be a required submittal to the Government.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive 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. Warranties: Sample of special warranties.

1.6 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. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C 1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

C. Fabricator Quality Control: Test all heat treated glass for distortion.

D. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

F. 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.
G. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

H. Source Limitations for Glass: Obtain tinted float glass, laminated glass, and insulating glass from single source from single manufacturer for each glass type.

I. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

J. Fabricator's Qualifications: Minimum of 5 years of experience manufacturing sealed insulating glass units meeting ASTM E 774, Class CBA. Certified by manufacturer.

K. Manufacturer's Qualification: Minimum 5 years of experience manufacturing solar control coated glass.

L. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
2. Provide full size mockup for each glass type where heat strengthened or tempered glass is to be installed to ensure specified product aesthetics, clarity, and optical distortion is acceptable.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

M. 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.

1.7 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 recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1.9 Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Government and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Government and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Government and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products from one of the following:

1. Guardian Industries Corp
3. PPG Industries, Inc.

2.2 GLASS PRODUCTS, GENERAL

A. General: Fabricate glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Edge Deleting: Grind smooth and polish exposed glass edges, edges of butt-glazed, and any other situation where sight lines are not covered.
B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

C. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F with a maximum value of U-0.65.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program, with a maximum value of 0.25.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Float Glass: ASTM C 1036, Type I, Class 2 (tinted, heat absorbing, and light reducing) and Quality q3.

1. Color: As selected to match existing base standard.

C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated. The deviation from flatness at any peak to valley deviation shall not exceed 0.003 inch in the center of a lite and shall not exceed 0.008 inch within 10-1/2 inches of the leading or trailing edge.
2. Localized Warp: Maximum 0.03 inch over any 12 inch span.
3. Objectionable Visible Quench Patterns: Prohibited, as judged by the Owner and Architect.
4. For uncoated glass, comply with requirements for Condition A.
5. For coated vision glass, comply with requirements for Condition C (other coated glass).
6. Fully tempered (FT) glass shall be heat soak tested to eliminate the potential of spontaneous breakage due to nickel-sulfite inclusion.
7. Color: As selected to match existing base standard.

D. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.

E. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
   1. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
   2. Sealing System: Dual seal.
   3. Spacer Specifications: Manufacturer's standard spacer material and construction.

F. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent flat glass), Quality-Q3, and complying with other requirements specified.
   1. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048.
   2. Color: As selected to match existing base standard.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   2. EPDM, ASTM C 864.
   4. Thermoplastic polyolefin rubber, ASTM C 1115.
   5. Any material indicated above.
B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

2.5 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers’ written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected from manufacturer’s standard colors.

B. Elastomeric Glazing Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants:
   a. Type and Grade: S (single component) and NS (nonsag).
   b. Class: 50.
   c. Use Related to Exposure: NT (nontraffic).
   d. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
   e. Applications: Exterior and interior windows and storefront system.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials 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 with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

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.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze 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.

2.8 MONOLITHIC-GLASS TYPES

A. Clear float glass fully tempered float glass.
   1. Thickness: 1/4 inch.
   2. Provide safety glazing labeling.

2.9 INSULATING-GLASS TYPES

A. Refer to 08 05 00 – COMMON WORK RESULTS FOR OPENINGS Attachment for Window System Design Load Analysis.

2.10 INSULATING-LAMINATED-GLASS TYPES

A. Refer to 08 05 00 – COMMON WORK RESULTS FOR OPENINGS Attachment for Window System Design Load Analysis.

PART 3 - EXECUTION

3.1 GLAZING

A. General: 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.
   1. Glazing channel dimensions, provide necessary bite on glass, minimum edge and face clearances and in compliance with AT/FP requirements, and adequate sealant
thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

2. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

4. 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.

5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

6. Provide spacers for glass lites where length plus width is larger than 50 inches.

7. 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.

B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

1. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

2. 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.

3. Apply heel bead of elastomeric sealant.

4. 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.

5. Apply cap bead of elastomeric sealant over exposed edge of tape.

C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

1. 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.

2. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

3. Install gaskets so they protrude past face of glazing stops.

D. Sealant Glazing (Wet): 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.

1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.2 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08 80 00
SECTION 08 88 13 - FIRE-RESISTANT 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. Fire-resistance-rated glazing.

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.

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 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Sustainable Design Submittals:
      1. Product Data: For sealants, indicating VOC content.
   C. Glass Samples: For each type of glass product; 12 inches square.
   D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers and glass testing agency.

B. Product Certificates: For each type of glass and glazing product, from manufacturer.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. 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.

1.8 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.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. Manufacturer's Special Warranty on 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
B. 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 impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.


B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-RESISTANCE-RATED GLAZING

A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing according to ASTM E 119 or UL 263.

B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that the glazing is approved for use in walls, and the fire-resistance rating in minutes.
C. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   a. AGC Glass Company North America, Inc.
   b. Pilkington North America.
   c. SAFTI FIRST Fire Rated Glazing Solutions.
   d. Technical Glass Products.

2.6 **GLAZING ACCESSORIES**

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Sealant shall have a VOC content of 250 g/L or less.
2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

D. 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.

2.7 **MISCELLANEOUS GLAZING MATERIALS**

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
B. 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.

C. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

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 fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or
other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   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 minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking 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.

I. Set glass lites with proper orientation so that coatings face fire side or protected side 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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. 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.

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.

D. 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. 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 washaway 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.
C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 FIRE-RESISTANCE-RATED GLAZING SCHEDULE

A. Glass Type G7: 60-minute fire-resistance-rated glazing with 450 deg F temperature-rise limitation; laminated glass with intumescent interlayers.

END OF SECTION 088813
SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed, extruded-aluminum louvers.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

D. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
   1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
   2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Windborne-debris-impact-resistance test reports.

1.5 QUALITY ASSURANCE

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

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Structural Drawings.

C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Design earthquake spectral response acceleration, short period (Sds) for Project – refer to Structural Drawings.
2. Component Importance Factor: 1.5.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.


2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Airolite Company, LLC (The).
   c. Construction Specialties, Inc.
   d. Ruskin Company.

2. Louver Depth: 5 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
4. Louver Performance Ratings:
   a. Free Area: Not less than 50 percent of louver area.
   b. Air Performance: Not more than 0.10-inch wg static pressure drop at 600-fpm free-area exhaust intake velocity.
   c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph at a core-area intake velocity of 500 fpm.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.
B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
   2. Finish: Mill finish unless otherwise indicated.
   3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:
   1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.5 BLANK-OFF PANELS

A. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
   1. Thickness: 2 inches.
   2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
   3. Metal Facing Sheets: Galvanized-steel sheet, not less than 0.028-inch nominal thickness.
   4. Metal Facing Sheets: Stainless-steel sheet, not less than 0.031-inch nominal thickness.
   5. Insulating Core: extruded-polystyrene foam.
   6. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
   7. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
   9. Attach blank-off panels with sheet metal screws.

2.6 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
   3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.7 FABRICATION

A. Factory-assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   1. Horizontal Mullions: Provide horizontal mullions at joints where indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
   1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
   2. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
   3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

G. Provide subsills made of same material as louvers or extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.
2.8 **ALUMINUM FINISHES**

A. Finish louvers after assembly.

B. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and 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.

1. Color and Gloss: sample as selected from manufacturer's full range.

**PART 3 - EXECUTION**

3.1 **EXAMINATION**

A. Examine substrates and openings, 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. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 **INSTALLATION**

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. 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.
3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. 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 08 91 19
SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For firestop tracks, from ICC-ES.

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 of the wall height based on horizontal loading of 5 lbf/sq. ft..
2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

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.

   1. Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 0.0312 inch.
      b. Depth: As indicated on Drawings.
   2. Embossed Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: As required by horizontal deflection performance requirements.
      b. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch 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 of the top of studs to provide lateral bracing.
   2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
   3. 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 the 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.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
      b. Grace Construction Products; FlameSafe FlowTrak System.
      c. Metal-Lite, Inc.; The System.
F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: 0.027 inch.

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
   1. Depth: 1-1/2 inches.
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base-Metal Thickness: 0.018 inch.
   2. Depth: 7/8 inch.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
      a. Type: Postinstalled, chemical anchor or postinstalled, expansion anchor.
   2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated unless noted otherwise.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
   1. Depth: 2-1/2 inches unless otherwise indicated on Drawings.

F. Furring Channels (Furring Members):
a. Minimum Base-Metal Thickness: 0.018 inch.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide products from one of the following:
   b. Chicago Metallic Corporation; Drywall Grid System.
   c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

   1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. 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.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. 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 clearance from jamb stud to allow for installation of control joint in finished assembly.
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.
E. Direct Furring:
   1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches o.c.
   2. Carrying Channels (Main Runners): 48 inches o.c.
   3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
      4. Do not attach hangers to steel roof deck.
      5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
      6. 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 measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16
SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum board.
   2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regionally manufactured and regionally extracted and manufactured materials. Include statement indicating cost for each regionally manufactured material.
      a. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.
      b. Include statement indicating location of manufacturer and point of extraction, harvest, or recovery for each raw material used in regionally extracted and manufactured materials. Indicate distance to Project and fraction by weight of each regionally manufactured material that is regionally extracted.
   3. Product Data for Credit IEQ 4.1: For adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.

C. All test results shall be a required submittal to the Government.

D. Contractor shall submit qualifications of any required Independent Testing and Inspection Agent in advance for Government approval.

1.3 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.
1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 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. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
   1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

C. Prevention of Mold: Comply with the requirements of GA 238 to prevent the growth of mold on gypsum board.

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
2.3 PAPER FACED INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corp.
2. Georgia-Pacific Gypsum LLC.
3. Lafarge North America Inc.
5. Temple-Inland.
6. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.


1. Core: 5/8 inch, regular type. (Type X where required for rating.)
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

F. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, regular type. (Type X where required for rating.)
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. CertainTeed Corp.; FiberCement BackerBoard.
b. James Hardie Building Products, Inc.; Hardiebacker.
d. USG Corporation; DUROCK Cement Board.

2. Thickness: 1/2 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Basis-of-Design: Subject to compliance with requirements, provide Fry Reglet Corporations’s Picture Hanger Reveal.
      a. Gordon, Inc.
      b. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Basis-of-Design: Subject to compliance with requirements, provide Fry Reglet Corporations’s “L” Trim Molding.
      a. Gordon, Inc.
      b. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and Taping (Level 1): For embedding tape coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
   a. Use setting-type compound for installing paper-faced metal trim access.
3. First Coat (Level 2): For first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
4. Fill Coat (Level 3): For second coat, use drying-type, all-purpose compound.
5. Finish Coat (Level 4): For third coat, use drying-type, all-purpose compound.
6. Skim Coat (Level 5): For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
   a. Comply with applicable requirements in Section 09 91 23 “Interior Painting” for Primer-Surfacers.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer’s written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, 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 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. Install control joints according to ASTM C 840 and manufacturer’s recommendations and in specific locations approved by Architect for visual effect or as indicated on the drawings.

1. Install control joints at fire rated walls according to UL Listing to maintain the fire rated assembly.
2. Do not bridge building expansion and control joints with gypsum board. Cut and space edges to match structural support.

G. 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. 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- wide joints to install sealant.
H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- 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.

I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

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 recommendations 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. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assembly.
3. Ceiling Type: Ceiling surfaces.
4. Abuse-Resistant Type: As indicated on Drawings/Partition Types.
5. Moisture- and Mold-Resistant Type: At all toilets, showers, janitor closets, break rooms, and kitchens.
6. Cementitious Backer Unit Type: Vertical surfaces receiving tiling.

B. 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) 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.
3. On Z-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. Fasten in patterns and on centers according to manufacturer’s written instructions.

C. 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 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-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 with screws; fasten face layers with adhesive and supplementary fasteners. Fasten in patterns and on centers according to manufacturer’s written instructions.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. 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 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. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.

D. Aluminum Trim: Install in locations indicated on Drawings.

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: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated on Drawings unless a higher level of finish is required for fire resistance-rated assemblies.
3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where walls are to receive heavy or medium texture finishes before final painting and where indicated.
4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
5. Level 5: For all-purpose compound embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface at walls with high gloss paint or walls exposed to direct lighting (recessed, spot lighting or natural) or where indicated. For Primer-Surferc comply with applicable requirements in Section 099123 "Interior Painting."
6. Extend finishes to bottom edge of gypsum board unless otherwise directed

E. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-gypsum board surfaces. Repair surfaces stained, marred, or otherwise damaged during gypsum board 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 09 29 00
SECTION 09 30 00 – TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ceramic tile.
   2. Stone thresholds.
   3. Waterproof membrane.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.


C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.3 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028.

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and
manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.

3. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.

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 each type of tile and grout indicated. Include Samples of accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of product, signed by product manufacturer.

C. Material Test Reports: For each tile-setting and -grouting product.

1.6 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 2 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 2 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Stone thresholds.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Joint sealants.
5. Metal edge strips.

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 mockup of each type of floor tile installation.
   2. Build mockup of each type of wall tile installation.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.8 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.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As reference on the Material Legend.

C. 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 TCA installation methods specified in tile installation schedules, and other requirements specified.

D. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

E. 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.

F. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

G. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 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 above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 12 per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.3 SETTING MATERIALS


1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
2.4 GROUT MATERIALS
   A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

2.5 CRACK ISOLATION MEMBRANE
   A. General: Manufacturer's standard product, selected from the following, 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 nominal thickness.
   C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch nominal thickness.
   D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.

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; 0.030-inch nominal thickness.
   C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch nominal thickness.
   D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
   E. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch nominal thickness.

2.7 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. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. 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.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives bonded mortar bed or thin-set 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 adhesives or thin-set 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 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.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

   a. Tile floors in wet areas.
   b. Tile floors composed of 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.
   1. Provide bullnose at outside corners and tile to gypsum board transitions.
   2. Provide inside and outside corner base trim.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   2. Glazed Wall Tile: 1/16 inch.

G. At locations where tile butts to base, provide a sealant joint between the floor tile and base. Base that rest on top of tile does not require a joint and should be kept free of grout.

H. At inside corners of wall tile, provide a sealant joint for wall to wall change in directions matching the color of the grout.

I. Tiles to be cut to size shall have the cut edge finished to match the factory edge.

J. All saw joints under quarry tile shall have a soft joint.

K. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

L. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

M. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
   1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-Portland cement mortar (thin set).
   2. Do not extend cleavage membrane waterproofing or crack isolation membrane under thresholds set in dry-set Portland cement or latex-Portland cement mortar. Fill joints
between such thresholds and adjoining tile set on cleavage membrane waterproofing or crack isolation membrane with elastomeric sealant.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove epoxy and latex-Portland cement 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. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
1. Tile Installation in dry locations: Thin-set mortar; TCNA F115.
   a. Tile Type: Unglazed ceramic mosaic and porcelain tile.
   b. Thin-Set Mortar: Latex- portland cement mortar.

B. Interior Wall Installations, Steel Studs or Furring:

1. Tile Installation in dry locations: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCNA W231/W241.
   a. Tile Type: Glazed Wall tile.
   b. Thin-Set Mortar: Latex- portland cement mortar.

2. Tile Installation in shower locations W222: Cement mortar on cementitious backer units or fiber cement underlayment; TCA W222.
   a. Tile Type: Glazed Wall Tile.
   d. Waterproof Membrane:

3. Shower Receptor and Wall Installations, Thin-set mortar on cementitious backer units or fiber cement underlayment; B412.
   a. Tile Type: Glazed Wall Tile.
   b. Thin-Set Mortar: Latex- portland cement mortar
   c. Grout: Polymer-modified unsanded grout.
   d. Waterproof Membrane:

END OF SECTION 09 30 00
SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Laboratory Test Reports: For ceiling products, indicating compliance with requirements for low-emitting materials.

C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

D. Samples for Initial Selection: For components with factory-applied finishes.

1.4 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. Ceiling suspension-system members.
   2. Structural members to which suspension systems will be attached.
   3. Method of attaching hangers to building structure.
      a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
   4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:
   a. Lighting fixtures.
   b. Diffusers.
   c. Grilles.
   d. Speakers.
   e. Sprinklers.

B. Qualification Data: For testing agency.
C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For finishes 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. Acoustical Ceiling Units: 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.

1.7 QUALITY ASSURANCE
A. 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 ceiling area as shown on Drawings.
   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.
1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver acoustical panels, suspension-system components, and accessories to Project site 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.

1.9 FIELD CONDITIONS
A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS
A. Ceiling products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
C. 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: Class A according to ASTM E 1264.
   2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS
A. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for acoustical tiles and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
1. As referenced on the Material Legend.

2.4 WOVEN WIRE PANELS

A. Colors, Textures, and Patterns: Where manufacturer’s standard products are indicated for woven wire and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As referenced on the Material Legend.

2.5 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer’s standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.

A. 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 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.

2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
5. Cap Finish: As indicated on the Material Legend

2.6 ACCESSORIES

A. 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/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

   a. Type: Post-installed expansion anchors.
   b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.
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.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

   2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

F. Hold-Down Clips: Manufacturer's standard hold-down.

G. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.7 METAL EDGE MOLDINGS AND TRIM

A. 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. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and 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.
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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

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 to structure 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, post-installed 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 o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

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 post-installed 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. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.

2. 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 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 axis of space.

2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

4. Install hold-down clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
   a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

5. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.
3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
   1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
   1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
   2. 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, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
END OF SECTION 09 51 13
SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For resilient base and stair accessories, indicating compliance with requirements for low-emitting materials.

C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.3 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.
1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F for more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F for more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Resilient base and stair accessories shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 THERMOSET-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
2. Flexco.
3. Roppe Corporation, USA.
4. Armstrong Flooring, Inc.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.
G. Inside Corners: Job formed.

H. Colors: As referenced on the material legend.

2.3 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. Roppe Corporations, USA
   3. VPI Corporation.

B. Description: Rubber cap for cove carpet, cap for cove resilient flooring, nosing for resilient flooring, reducer strip for resilient flooring, and transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As referenced on the materials legend.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
   1. Adhesives shall have a VOC content of 50 g/L or less and 60 g/L or less for rubber stair treads.
   2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer’s written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer’s written recommendations, but not less stringent than the following:

      a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate allowable per manufacturer’s recommendation.
      b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

G. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13
SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl composition floor tile.
2. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-tile manufacturer for applications indicated.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. Product Data for Credit IEQ 4.3: For adhesives, documentation including printed statement of VOC content.
3. Product Data for Credit IEQ 4.3: For resilient tile flooring, documentation from an independent testing agency indicating compliance with the FloorScore standard.

C. Samples: Full-size units of each color and pattern of floor tile required.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

E. All test results shall be a required submittal to the Government.

F. Contractor shall submit qualifications of any required Independent Testing and Inspection Agent in advance for Government approval.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.
1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.

C. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 VINYL COMPOSITION FLOOR TILE (LVT-1)

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Tandus Centiva.
2. Armstrong World Industries, Inc.
3. Congoleum Corporation.
4. Mannington Mills, Inc.
5. Tarkett, Inc.

B. Tile Standard: ASTM F 1700, Class III, type B.

C. Wear Layer Thickness: 32 mil

D. Total Thickness: 0.120 inch.

E. Size: 18 by 18 inches.

F. Edge Treatment: Square Edge

G. Emboss: Passage

H. Colors and Patterns: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

1. Adhesives shall comply with the following limits for VOC content:
   a. Vinyl Composition Tile Adhesives: 50 g/L or less.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
   a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
   b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

   1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

   1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

   1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply two coats.

E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19
SECTION 09 65 36 - STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Static-dissipative, vinyl composition floor tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to static-control resilient flooring including, but not limited to, the following:

a. Examination and preparation of substrates to receive static-control resilient flooring.

b. Installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

3. Product Data: For chemical-bonding compounds, indicating VOC content.

4. Laboratory Test Reports: For chemical-bonding compounds, indicating compliance with requirements for low-emitting materials.

5. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For each type of static-control resilient flooring. Include floor-covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

2. Show locations of inscribed maintenance tiles.

3. Submit grounding diagram showing location of grounding strips and connections.

D. Samples for Initial Selection: For each type of static-control resilient flooring.
1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for static-control resilient flooring.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of static-control resilient flooring 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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for static-control resilient flooring.

   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store static-control resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer but not less than 50 deg F or more than 90 deg F.

   1. Floor Tile: Store on flat surfaces.

1.9 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive static-control resilient flooring during the following time periods:

   1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during static-control resilient flooring installation.

D. Close spaces to traffic for 48 hours after static-control resilient flooring installation.

E. Install static-control resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Static-Dissipative Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.

1. Electrical Resistance: Test per ASTM F 150 with 100-V applied voltage.
   a. Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
   b. Average greater than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.

2. Static Generation: Less than 300 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.

3. Static Decay: 5000 to zero V in less than 0.25 seconds when tested per FED-STD-101C/4046.1.

B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 STATIC-DISSIPATIVE RESILIENT FLOOR COVERINGS

A. Static-Dissipative, Solid Vinyl Floor Tile: ASTM F 1700, Class I (monolithic), Type A (smooth surface).
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Johnsonite; a Tarkett company.
   b. Roppe Corporation, USA.
   c. VPI Corporation.

2. Thickness: In manufacturer's standard thickness, but not less than 0.08 inch.
4. Colors and Patterns: As referenced on the material legend.

### 2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.
   1. Adhesives shall have a VOC content of 50 g/L or less.
   2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor-covering system to ground connection.

D. Maintenance Floor Tiles: Special floor tiles inscribed "Conductive floor. Do not wax."

E. Floor Polish: Provide protective, static-control liquid floor polish products as recommended by floor-covering manufacturer.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion or static-control characteristics of floor coverings.

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

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of static-control resilient flooring and electrical continuity of floor-covering systems.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with floor-covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft.in 24 hours.
      b. Perform relative-humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative-humidity level measurement.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install static-control resilient flooring until it is same temperature as space where it is to be installed.
   1. Move static-control resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum substrates to be covered by static-control resilient flooring immediately before installation.

3.3 INSTALLATION, GENERAL

A. Install static-control resilient flooring according to manufacturer's written instructions.

B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.

C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings. Extend static-control resilient flooring to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install static-control resilient flooring on covers for telephone and electrical ducts, and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of static-control resilient flooring installed on covers. Tightly adhere static-control resilient flooring edges to substrates that abut covers and to cover perimeters.

G. Adhere static-control resilient flooring to substrates using a full spread of static-control adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.

   1. Lay floor tiles square with room axis.

C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

   1. Lay static-dissipative, vinyl composition floor tiles with grain direction alternating in adjacent floor tiles (basket-weave pattern).

D. In each space where conductive, solid vinyl floor tile is installed, install maintenance floor tile identifying conductive floor tile in locations approved by Architect.

3.5 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to test electrical resistance of static-control resilient flooring for compliance with requirements.

   1. Arrange for testing after static-control adhesives have fully cured and static-control resilient flooring has stabilized to ambient conditions and after ground connections are completed.

B. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of static-control resilient flooring.

B. Perform the following operations immediately after completing static-control resilient flooring:
   1. Remove static-control adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect static-control resilient flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. Do not wax static-control resilient flooring.
   2. If recommended in writing by manufacturer, apply protective static-control floor polish formulated to maintain or enhance floor covering's electrical properties; ensure static-control resilient flooring surfaces are free from soil, static-control adhesive, and surface blemishes.
      a. Verify that both floor polish and its application method are approved by manufacturer and that floor polish will not leave an insulating film that reduces static-control resilient flooring's effectiveness for static control.

D. Cover static-control resilient flooring until Substantial Completion.

END OF SECTION 09 65 36
SECTION 09 67 23 - RESINOUS FLOORING

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 resinous flooring systems.

1.3 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
B. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.
A. LEED Submittal:
1. Product Data for Credit EQ 4.2: For sealants, including printed statement of VOC content.

1.5 INFORMATIONAL SUBMITTALS
A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
B. Material Certificates: For each resinous flooring component, from manufacturer.
C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS
A. Maintenance Data: For resinous flooring to include in maintenance manuals.
1.7 QUALITY ASSURANCE

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

B. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 96-inch-square floor area selected by Architect.
   a. Include 96-inch length of integral cove base with inside and outside corner.

2. Simulate finished lighting conditions for Architect's review of mockups.
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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

1.10 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing according to ASTM D 635.

2.2 MANUFACTURERS

A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

2.3 RESINOUS FLOORING RF-1

A. Basis of Design: A five-coat flooring system consisting of an epoxy primer, epoxy mortar coat, epoxy grout coat, and an aliphatic urethane. Basis of design is Stonelad GS with Stonseal GS6 sealant as manufactured by Stonhard, Inc. or a comparable system from one of the following:

   a. Crossfield Products Corp.
   b. Sika Corporation; Flooring.
   c. Tennant Company.

B. System Characteristics:

   1. Color and Pattern: As indicated on Drawings.
   2. Wearing Surface: Aliphatic urethane with integrated #60 grit aluminum oxide Overall System Thickness: Nominal 1/4 inch thickness.

C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.

   1. Formulation Description: 100 percent solids bisphenol A epoxy primer.

D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

E. Body Coats:

   1. Resin: General service bisphenol A epoxy mortar
   2. Application Method: Troweled mortar utilizing a screed box and power trowel
   3. Thickness of Coats: 1/4"

F. Grout Coat:

   1. Resin: General service bisphenol A epoxy coating
RESINOUS FLOORING

2.4 RESINOUS FLOORING RF-2

A. Basis of Design: A three-coat flooring system consisting of an epoxy primer, aliphatic urethane grout coat and an aliphatic urethane topcoat. This system includes #60 grit aluminum oxide for slip resistance. Basis of design is Stonkote GS4 with Stonseal GS6 sealant as manufactured by Stonhard, Inc. or a comparable system from one of the following:

a. Crossfield Products Corp.
b. Sika Corporation; Flooring.
c. Tennant Company.

B. System Characteristics:

1. Color and Pattern: As indicated on Drawings.
2. Wearing Surface: Aliphatic urethane with integrated #60 grit aluminum oxide

C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.

1. Formulation Description: 100 percent solids bisphenol F epoxy primer.

D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
E. Body Coats:

1. Resin: Aliphatic urethane
2. Type: Pigmented
3. Application Method: Self leveling grout coat applied with notched squeegee.
4. Number of Coats: One
5. Thickness of Coats: nominal 3-4 mils
6. Aggregates: #60 grit aluminum oxide

F. Topcoats: Sealing or finish coats:

1. Resin: Aliphatic urethane
2. Type: Pigmented
3. Application Method: Self leveling grout coat applied with notched squeegee
4. Number of Coats: One
5. Thickness of Coats: nominal 3-4 mils
6. Aggregates: #60 grit aluminum oxide

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:
   a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
   b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

   a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
   b. Plastic Sheet Test: ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 APPLICATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 6 inches high.

D. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.

E. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.

F. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.
3.3 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.

3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

B. Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.4 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723
SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

B. LEED Submittals:
   a. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   b. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
   c. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.
   d. Product data from manufacturers indicating compliance with EQ Credit 4.3.

C. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. 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.

2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

1.4 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.

1.5 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.

1.6 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 2 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 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. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

1.9 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 occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of face fiber, and delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for carpet tile and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As referenced on the Material Legend.
B. Performance Characteristics: As follows:

1. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
2. Delamination: Not less than 3.5 lbf/in. according to ASTM D 3936.
3. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
4. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
5. Resistance to Insects: Comply with AATCC 24.
6. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
7. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
8. 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.
9. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Metal Edge/Transition Strips: Types and finishes referenced in materials legend. Provide strip 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. Examine carpet tile for type, color, pattern, and potential defects.

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 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

   a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

   b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

   c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch, protrusions more than 1/32 inch, 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 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 wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed 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: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. 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, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.

B. Protect installed carpet tile to comply with CRI's "CRI 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 09 68 13
SECTION 09 69 00 - ACCESS FLOORING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Cementitious-core steel panel access flooring.

1.2 COORDINATION
A. Coordinate location of mechanical and electrical work in underfloor cavity to prevent interference with access flooring.
B. Mark pedestal locations on subfloor to enable mechanical and electrical work to proceed without interfering with access-flooring pedestals installed after mechanical and electrical work.

1.3 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.
   1. Review connections between access flooring and mechanical and electrical systems.

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 for access flooring.
   2. Include loading capacities.
B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
C. Shop Drawings: For access flooring:
   1. Include layout of access flooring and relationship to adjoining Work based on field-verified dimensions.
   2. Details and sections with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories, and understructures.
D. Delegated-Design Submittal: For seismic design of access flooring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.
B. Product Certificates: For each type of access flooring.
C. Product Test Reports: For each type of access-floors material and floor covering, performed by a qualified testing agency.
D. Seismic Design Calculations: For seismic design of access flooring, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
E. Preconstruction Test Reports: For preconstruction adhesive field test.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical access flooring, as shown on Drawings. Size to be an area no fewer than five floor panels in length by five floor panels in width.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer 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 FIELD CONDITIONS

A. Environmental Limitations: Do not install access flooring until spaces are enclosed, subfloor has been sealed, ambient temperature is between 50 and 90 deg F, and relative humidity is not less than 20 and not more than 70 percent.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design access flooring for seismic performance, including loads imposed on the access flooring by items and equipment installed on the access flooring.
B. Seismic Performance: Access flooring shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Structural Performance: Provide access flooring capable of complying with the following performance requirements according to testing procedures in CISCA's "Recommended Test Procedures for Access Floors"

1. Concentrated Loads: 1000 lbf with the following deflection and permanent set:
   a. Top-Surface Deflection: 0.10 inch.
   b. Permanent Set: 0.010 inch.

3. Rolling Loads: 800 lbs with local or overall deformation not to exceed 0.040 inch.

4. Stringer Load Test: 225 lbf at center of span with a permanent set not to exceed 0.010 inch.
5. Pedestal Axial Load Test: 5000 lbf.
6. Pedestal-Overturing-Moment Test: 1000 lbf x inches.
7. Uniform Load Test: 250 lbf/sq. ft. with a maximum top-surface deflection not to exceed 0.040 inch and a permanent set not to exceed 0.010 inch.

D. Fire Performance:

1. 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 or less.
   b. Smoke-Developed Index: 50 or less.

E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 CEMENTITIOUS-CORE STEEL PANEL ACCESS FLOORING

A. Fabricate panels from cold-rolled steel sheet, with die-cut flat top sheet and die-formed and stiffened bottom pan welded together. Protect metal surfaces against corrosion using manufacturer's standard factory-applied finish. Fully grout internal spaces of completed units with manufacturer's standard cementitious fill.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASM Modular Systems, Inc.
   b. Camino Modular Systems, Inc.
   c. Computer Environments, Inc.
   d. Haworth, Inc.
   e. Tate Access Floors, Inc.
2. Configuration: Provide modular panels with nominal size of 24 by 24 inches, interchangeable with other field panels without disturbing adjacent panels or understructure.

3. Attachment to Understructure: Bolted.

B. Pedestal System Understructure: System consisting of base, column with provisions for height adjustment, and head (cap); made of steel.

1. Base: Square or circular base with not less than 16 sq. in. of bearing area.
2. Column: Of height required to bring finished floor to elevations indicated. Weld to base plate.
3. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches and for locking at a selected height, so deliberate action is required to change height setting and prevent vibratory displacement.
4. Head: Designed to support the floor panel indicated.

C. Stringer System Understructure: Modular steel stringer systems designed to bolt to pedestal heads and form a grid pattern. Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.

D. Colors, Textures, and Patterns: Refer to Section 09 65 36 Static-control Resilient Flooring and Section 09 68 13 Tile Carpeting, and Material Legend.

2.3 FABRICATION

A. Fabrication Tolerances:

1. Size: Plus or minus 0.020 inch of required size.
2. Squareness: Plus or minus 0.015 inch between diagonal measurements across top of panel.
3. Flatness: Plus or minus 0.035 inch, measured on a diagonal on top of panel.

B. Panel Markings: Clearly and permanently mark floor panels on their underside with panel type and concentrated-load rating.

C. Bolted Panels: Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.

1. Captive Fasteners: Provide fasteners held captive to panels.

D. Cutouts: Fabricate cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with structural performance requirements.

1. Number, Size, Shape, and Location: As required per the Electrical and Telecommunication drawings.
2. Grommets: Where indicated, fit cutouts with manufacturer's standard grommets; or, if size of cutouts exceeds maximum grommet size available, trim edge of cutouts with
manufacturer's standard plastic molding with tapered top flange. Furnish removable covers for grommets.

2.4 ACCESSORIES

A. Panel Lifting Device: Panel manufacturer's standard portable lifting device for each type of panel required for each computer room.

B. Perimeter Support: Where indicated, provide manufacturer's standard method for supporting panel edge and forming transition between access flooring and adjoining floor coverings at same level as access flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer and manufacturer's authorized representative present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of conditions and deleterious substances that might interfere with attachment of pedestals.

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

3.2 PREPARATION

A. Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than 6 inches.

B. Locate each pedestal, complete any necessary subfloor preparation, and vacuum subfloor to remove dust, dirt, and construction debris before beginning installation.

3.3 INSTALLATION

A. Install access flooring and accessories under supervision of access-flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.

B. Mechanical Attachment of Pedestals: Attach pedestals to subfloor with post-installed mechanical anchors as required to meet seismic design requirements.

C. Adjust pedestals so installed panels are flat, level, and at the proper height.
D. Stringer Systems: Secure stringers to pedestal heads according to access-flooring manufacturer's written instructions.

E. Install flooring panels securely in place, leaving them properly seated with panel edges flush. Do not force panels into place.

F. Scribe perimeter panels to provide a close fit, with adjoining construction having no voids greater than 1/8 inch where panels abut vertical surfaces.
   1. To prevent dusting, seal cut edges of steel-encapsulated, wood-core panels with sealer recommended in writing by panel manufacturer.

G. Cut and trim access flooring and perform other dirt-or-debris-producing activities at a remote location or as required to prevent contamination of subfloor under installed access flooring.

H. Grounded Access Flooring: Ground access flooring as recommended by manufacturer and as needed to comply with performance requirements for electrical resistance of floor coverings.
   1. Panel-to-Understructure Resistance: Not more than 10 ohms as measured without floor coverings.

I. Clean dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area as installation of floor panels proceeds.

3.4 PROTECTION

A. Prohibit traffic on access flooring for 24 hours and removal of floor panels for 72 hours after installation, to allow pedestal adhesive to set.

B. Replace access-flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

END OF SECTION 09 69 00
SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Steel.
   2. Galvanized metal.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. VOC content.

D. Substrates and Conditions Examination: Provide written report indicating compliance with moisture and humidity requirements contained in this document and as recommended by the painting manufacturer.

1.3 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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.
1.4 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. Contracting Officer will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
   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.

B. Pre-installation Conference: Conduct conference at Project site.

1.5 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.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Provide a product from one of the manufacturers listed below and that meets the requirements of the Basis of Design under Part 3 articles for the paint category indicated.

1. MAB
2. Sherwin Williams
3. Benjamin Moore
4. Porter Paints
5. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As reference on the Material Legend.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. 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 shall 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.

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Percentages in five subparagraphs below are based on "MPI Manual."
   b. Masonry (CMU): 12 percent.

2. Provide written report indicating compliance with moisture and humidity requirements contained in this document and as recommended by the painting manufacturer.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. 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 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. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."
E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 2 for touching up shop-primed surfaces.

F. 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. Comply with SSPC-SP 2, "Hand Tool Cleaning."

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI 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. 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 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. Pipe hangers and supports.
   d. Metal conduit.
   e. Plastic conduit.
   f. Tanks that do not have factory-applied final finishes.
3.4 DRY THICKNESS SCHEDULE

A. General: Unless otherwise recommended by the painting manufacturer for paint indicated, provide the minimum dry thickness for exterior use that complies with the following:

B. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Acrylic-Enamel Finish:
   a. Primer: 6 mils wet, 3 mils dry.
   b. First and Second Coats: 2-4 mils dry per coat.

C. Zinc-Coated Metal:

1. Acrylic-Enamel Finish:
   a. First and Second Coats: 2-4 mils dry per coat.

3.5 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.

3.6 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.
3.7 EXTERIOR PAINTING SCHEDULE

A. General: Provide materials and products for exterior use that result in colors and textures of paint complying with the following:

B. Ferrous Metal: As follows:

1. 1st Coat: Sherwin-Williams DTM Acrylic Primer/Finish.
2. 2nd Coat: Sherwin-Williams DTM Acrylic Coating.
3. 3rd Coat: Sherwin-Williams DTM Acrylic Coating.

C. Zinc-Coated Metal: As follows:

1. 1st Coat: Sherwin-Williams DTM Acrylic Coating.
2. 2nd Coat: Sherwin-Williams DTM Acrylic Coating.

END OF SECTION 09 91 13
SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete masonry units (CMU).
2. Concrete.
3. Steel.
5. Gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. LEED Submittals:

1. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.

C. 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 square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

E. Substrates and Conditions Examination: Provide written report indicating compliance with moisture and humidity requirements contained in this document and as recommended by the painting manufacturer.
1.3 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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 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. Contracting Officer will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
         a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
         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 Government.
      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.
   B. Pre-installation Conference: Conduct conference at Project site.

1.5 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.
      1. Maintain containers in clean condition, free of foreign materials and residue.
      2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS
   A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
   B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Provide a product from one of the manufacturers listed below and that meets the requirements of the Basis of Design under Part 3 articles for the paint category indicated.

1. MAB
2. Benjamin Moore
3. Porter Paints
4. PPG Architectural Finishes, Inc.
5. Scuffmaster

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Colors: As reference on the Material Legend.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Government reserves the right to invoke the following procedure:
1. Government may 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. Government may direct Contractor to stop applying coatings 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.

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

   a. Masonry (CMU): 12 percent.
   b. Concrete: 12 percent.
   c. Gypsum Board: 12 percent.

2. Provide written report indicating compliance with moisture and humidity requirements contained in this document and as recommended by the painting manufacturer.

B. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. 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 Manual" applicable to substrates 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 exceed 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 but not less than the following:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 2 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints. Comply with SSPC-SP 2, "Hand Tool Cleaning."

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.

3.1 DRY FILM THICKNESS SCHEDULE

A. General: Unless otherwise recommended by the painting manufacturer for paint indicated, provide the minimum dry thickness for exterior use that complies with the following:

B. Primer-Surfacener: Finish Level 4 (GA-214/ASTM C-840) drywall surface with vinyl acrylic latex-based coating to achieve Level 5 gypsum board.

1. Coating shall be a high solids primer with at least 40 percent volume solids.
2. Primer should be applied to a dry film thickness of 1.7 to 1.8 mils.

C. Concrete and Masonry (Other than Concrete Masonry Units):

1. Acrylic Finish:
   a. Primer: 7 mils wet, 3 mils dry.
   b. First and Second Coats: 4 mils wet, 1.4 mils dry per coat.

D. Concrete Masonry Units

1. Acrylic Finish:
   a. Block Filler: 4.0 mils.
   b. First and Second Coats: 4 mils wet, 1.4 mils dry per coat.

E. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Acrylic Finish:
   a. Primer: 4 mils wet, 1.2 mils dry.
   b. First and Second Coats: 4 mils wet, 1.4 mils dry per coat.

F. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Acrylic Finish:
   a. Primer: 4 mils wet, 1.6 mils dry.
   b. First and Second Coats: 4 mils wet, 1.3 mils dry per coat.
G. Zinc-Coated Metal:
   1. Acrylic Finish:
      a. Primer: 4 mils wet, 1.6 mils dry.
      b. First and Second Coats: 4 mils wet, 1.3 mils dry per coat.

3.2 QUALITY CONTROL

A. Dry Film Thickness Testing: Government 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.

3.3 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.

3.4 INTERIOR PAINTING SCHEDULE

A. General: Provide materials and products for interior use that result in colors and textures of paint complying with or equal to the following:
B. Concrete Stripping: As follows:
   1. Heavy duty epoxy Armorseal 1000 HS with top coat full gloss clear epoxy coating Armorseal 650 SL/RC or approved equal.
C. Concrete Masonry Units: As follows:
   1. 1st Coat: Sherwin-Williams PrepRite Block Filler.
   2. 2nd Coat: Sherwin-Williams ProMar 200 Latex.
3. 3rd Coat: Sherwin-Williams ProMar 200 Latex.

D. Gypsum Board: As follows:
   1. High Humidity Areas:
      b. 2nd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy.
      c. 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy.

   2. Walls and Ceilings:
      b. 2nd Coat: Sherwin-Williams ProMar 200 Latex.
      c. 3rd Coat: Sherwin-Williams ProMar 200 Latex.

E. Ferrous Metal: As follows:
   1. 1st Coat: Sherwin-Williams All Surface Enamel Latex Primer.
   2. 2nd Coat: Sherwin-Williams ProMar 200 Latex.
   3. 3rd Coat: Sherwin-Williams ProMar 200 Latex.

F. Zinc-Coated Metal: As follows:
   1. 1st Coat: Sherwin-Williams All Surface Enamel Latex Primer.
   2. 2nd Coat: Sherwin-Williams ProMar 200 Latex.
   3. 3rd Coat: Sherwin-Williams ProMar 200 Latex.

END OF SECTION 09 91 23
SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Room-identification signs.
   2. Dimensional characters.

1.2 DEFINITIONS


1.3 ACTION SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
   3. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.

C. Shop Drawings: Submit dimensioned shop drawings and location plan of each type of sign required. Include Message Schedule submittal as noted within this section. Do not reproduce Contract Documents, or copy standard printed information as the basis of shop drawings.
   1. All Signage: Include full size details of sign wording and lettering layouts, except where lettering or graphic layout exceeds a width of 36 inches, in which case, half size layouts are acceptable. Outline representation of copy and typefaces is not sufficient. Copy shall be filled in solid black for all typefaces specified, for evaluation by Contracting Officer.
   2. In copy layouts, show proposed final spacing and interrelationships of letters (kerning), words, lines of text, arrows and graphic figures as well as locations and proportions of messages.
3. Show structural framing, connection details, base plates, and anchor bolt layouts, where required, and include templates where applicable. Indicate details for field connections, anchorages, diagrams and details indicating provision for movement, hinge connections, latching devices, fastening and sealing methods, hanging and support methods, and all other pertinent information.

Material and Finish Samples:

1. For each type of finished material specified, submit three samples of color and finish of exposed materials. Submit samples of accessories required. The Contracting Officer review of samples will be for color and texture only. One set of samples will be kept by the Contracting Officer (CO) as a record to match against items installed at the job site.

a. Submittals should include but are not limited to:

1) Painted Aluminum.
2) All Paint Colors.
3) Metallic Samples.

E. LEED Submittals:

1. Required: Credit MR 5.1, manufacturers' product data for signs, including printed statement indicating local/regional locations where product is manufactured, fabricated and produced within 500 miles of construction site.
2. Required: Prerequisite EQ 2, there shall be no smoking areas located within any building, or within 25 feet of any building entry, outdoor air intake, or operable windows.
3. Required: Credit EQ 4.1, manufacturers' product data for signs, including printed statement of VOC content and chemical components.
4. Credit MR 5.1, manufacturers' product data for signs, including printed statement of minimum recycled contents for product.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MATERIALS
1. In this Article, retain only materials that are referenced in other articles under specific signage requirements.

B. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
C. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

D. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

E. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

F. Provide up to five additional signs, from any type indicated within this section. Coordinate with message schedule submittal if required for installation.

2.2 DIMENSIONAL CHARACTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASI Signage Innovations
2. Innerface Sign Systems, Inc.
3. APCO Architectural Signs
4. Ace Sign Systems, Inc.
5. Best Sign Systems Inc.

B. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.

2. Thickness: As indicated.
3. Color(s): As selected by Architect from manufacturer’s full range.

2.3 SIGNS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASI Signage Innovations
2. Innerface Sign Systems, Inc.
3. APCO Architectural Signs
4. Ace Sign Systems, Inc.
5. Best Sign Systems Inc.
B. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
   a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
   c. Color(s): As selected by Architect from manufacturer's full range.


C. Changeable Message Inserts: Fabricate signs where indicated to allow insertion of changeable messages in the form of slide-in inserts.

1. Furnish insert material and software for creating text and symbols for PC-Windows computers for Government production of paper inserts.
2. Furnish insert material cut-to-size for changeable message insert.

D. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

2. Raised-Copy Thickness: Not less than 1/32 inch.

2.4 IDENTIFYING EMBLEM

A. The emblem shall be of a bright and reflective color, or made of reflective material. The shape of the emblem shall be 1/8-inch painted aluminum isosceles triangle and the size shall be 12 inches horizontally by six inches vertically.

1. The letters "R" to signify a roof with truss construction, of a size and color to make them conspicuous, shall be printed on the emblem.

2. The emblem shall be permanently affixed to the left of the main entrance door at a height between four and six feet above the ground and shall be installed and maintained by the owner of the building.

2.5 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.
2.6 SIGN TYPES

A. TYPE RI – ROOM IDENTITY

1. Dimensions: 5” x 11”
2. Thickness: ¼” outer-panel, ⅛” inner-panel, total 9/16”
3. Outer panel: ¼” unpainted clear area for 11” x 2 ¾” paper insert, and 2 ¼” Sub-surface of clear acrylic painted (to match Color 1) with engraved and raised cut out aluminum letters (for room number) and stainless steel raster grade 2 braille (registered with room name). Provide 1” radius semicircular thumb cut out for paper insert removal.
5. Room number font size: 5/8” bold (right registered)

B. TYPE SE – SUITE ENTRY ROOM

1. Dimensions: 6 1/2” x 11”
2. Thickness: ⅛” outer-panel, ¼” inner-panel, total 1/2”
3. Outer panel: Sub-surface of clear acrylic painted (to match Color 1) with engraved and raised cut out aluminum letters (for room name and number) and stainless steel raster grade 2 braille (registered with room name).
5. Room name font size (1st line): 5/8” bold (left registered)
6. Room name font size (2nd line): 5/8” bold (left registered)

C. TYPE RR – REST ROOM

1. Dimensions: 6 1/2” x 11”
2. Thickness: ⅛” outer-panel, ¼” inner-panel, total 1/2”
3. Outer panel: Sub-surface of clear acrylic painted (to match Color 1) with engraved and raised cut out aluminum letters (for room name and number) and stainless steel raster grade 2 braille (registered with room name).
5. Room name font size: 3/4” bold (right registered)
6. Graphic icon: 3 1/4” (left registered)

D. TYPE CD – CORRIDOR DIRECTIONAL

1. Dimensions: 6 1/2” x 11”
2. Thickness: ⅛” outer-panel, ¼” inner-panel, total 1/2”
3. Outer panel: Sub-surface of clear acrylic painted (to match Color 1) with engraved and raised cut out aluminum letters (for room name and number).
5. Graphic arrow: ½" (left registered)
6. Room/Suite name font size: 1/2” bold (left registered after icon)
7. Graphic arrow: ¾” (right registered)
8. Room/Suite name font size: 1/2” bold (right registered after icon)

E. EXTERIOR SIGNAGE: Internally illuminated, cast aluminum Dimensional Characters with concealed stud/bracket mounts, refer to drawings for locations and dimensions.

F. EXTERIOR EMBLEMS: Illuminated, 3/4” thk. painted aluminum with concealed stud mounts, final unit emblem/symbol artwork will be provided by NCANG Public Affairs office. Refer to drawings for locations and dimensions.

G. MISCELLANEOUS SIGNAGE: Provide exterior HAZMAT placard sign(s) in accordance with NFPA 704 standard. Locate at exterior façade adjacent to exterior doors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

3. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
4. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.
5. Exterior: Fasten to substrate according to manufacturer’s written recommendations.

B. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Mounting: 1/4-inch studs with concealed fasteners.
3.2 SCHEDULE

A. Sign Types: Provide interior and exterior signs as indicated on Signage Schedule.

3.3 MESSAGE SCHEDULES

A. Copy will be supplied by the Government; however, the cost for adding the copy shall be included in the contract.

B. For all sign types requiring message schedules, Contractor is required to meet with the Government prior to production and fabrication, to verify final messages in accordance with the Government’s and Contracting Officer's instructions. Submit final message schedule for Government sign off, prior to final production and fabrication. Furnish one complete updated copy of message schedule to Contracting Officer at time of Government’s final approval.

C. Sign Schedule:

1. TYPE RI:
   a. C-17 Hangar Main Level Rooms: #H104, #H105, #H106, #H107, #H108, #H109, #H110, #H115, #H117, #H118, #H119, #H126 (2 signs), #H127, #H128, #H130, #H136, #H137 (2 signs), #H138 (2 signs), #H151, #H152, #H153 (2 signs), #H154 (2 signs), #H166, #H167, #H168, #H001, #H002, #P101
   b. C-17 Hangar Upper Level Rooms: #H001, #H002
   c. C-17 Hangar Flight Simulator Rooms: #S105, #S106, #S107, #S109, #S111, #S112, #S115, #S116, #S117, #S118, #S119, #S121, #S123, #S124, #S126, #S127, #S128, #S129

2. TYPE SE:
   a. C-17 Hangar Main Level Rooms: #H116

3. TYPE RR:
   a. C-17 Hangar Main Level Rooms: #H113, #H114, #H131, #H133
   b. C-17 Flight Simulator Rooms: #S108, #S110

4. TYPE CD:
   a. C-17 Hangar Main Level Rooms: #H102 (2 signs), #H103, #H125, #H139, #H150

END OF SECTION 10 14 00
SECTION 10 21 13.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures.

1.2 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. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

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.
5. Show overhead support or bracing locations.

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-square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.
1.4 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 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 E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      1. Flame-Spread Index: 25 or less.
      2. Smoke-Developed Index: 450 or less.
   
   B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
   
   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-PLASTIC TOILET COMPARTMENTS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Accurate Partitions Corp.; ASI Group.
      2. Bradley Corporation.
      5. Hadrian Manufacturing Inc.
   
   B. Toilet-Enclosure Style: Overhead braced floor anchored.
   
   C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) 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. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard continuous, stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.

3. Color and Pattern: Refer to material legend.

D. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

E. Brackets (Fittings):
   1. Stirrup Type: Ear or U-brackets, stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
   2. Hinges: Manufacturer's standard integral hinge for solid-plastic doors, allowing emergency access by lifting door.
   3. Latch and Keeper: Manufacturer's standard recessed 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. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. 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. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-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.
   b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached 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.

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 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.
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 10 21 13.19
SECTION 10 22 19 - DEMOUNTABLE PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Unitized-panel demountable partitions.

1.2 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For demountable partitions.
   1. Include diagrams for power-, signal-, and control-wiring raceways.
   2. Include layout, spacing, sizes, fasteners, and anchorage details of panels and required bracing.
   3. Delegated Design Submittal: Refer to Article 2.1.

D. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale and coordinated with each other, using input from the installers of the items involved.

B. Product Certificates.

C. Product Test Reports.
1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Delegated Design: Design partitions in accordance with IBC 2012. Design bracing to support partitions for a horizontal load. The horizontal load shall be the greater of 5 psf or the seismic load per IBC 2012/ASCE 7. Delegated design efforts layout shall also include all modifications required for all affected components and systems, to include but not limited to: acoustical ceilings, mechanical ductwork and diffusers, lighting, fire suppression locations, etc. required to provide a complete and fully operational facility consistent with all components and systems, in lieu of gypsum board partitions, as shown in the Base Bid documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Acoustical Performance: Where acoustical rating is indicated, provide demountable-partition assembly tested by a qualified testing agency for sound transmission loss performance according to ASTM E 90, calculated according to ASTM E 413, and rated for not less than the STC value indicated.

B. Delegated Design: Engage a qualified professional engineer to design required bracing requirements. Delegated design efforts layout shall also include all modifications required for all affected components and systems, to include but not limited to: acoustical ceilings, mechanical ductwork and diffusers, lighting, fire suppression locations, etc. required to provide a complete and fully operational facility consistent with all components and systems, in lieu of gypsum board partitions, as shown in the Base Bid documents.

C. Structural Performance: Provide steel framing capable of withstanding design loads within limits and under conditions in accordance with IBC 2012 and as follows:

1. Seismic Criteria:
   Design Spectral Response Acceleration (short period), $S_{DS}$: 0.171
   Design Spectral Response Acceleration (1 sec period), $S_{D1}$: 0.096
   Site Class (assumed): D
   Seismic Design Category: C

2. Provide a system to allow for construction tolerances and existing conditions and to accommodate live/snow load deflection of primary building structure that supports the ceiling and required panel bracing.
2.2 UNITIZED-PANEL DEMOUNTABLE PARTITIONS

A. General: Unitized, demountable-partition assembly and components that are the standard products of manufacturer.

1. Basis of Design: Subject to compliance with requirements, provide Steelcase Privacy Wall with Enhanced Core and Privacy Wall Glass Panels or products by the following:
   a. Haworth, Inc.
   b. Inscape Corporation.
   c. Panelfold Inc.

B. Unitized Panels: Manufacturer’s standard steel-sheet-faced.

1. Thickness: Manufacturer’s standard.
3. Finish:
   a. Steel: Factory-applied, baked-enamel or powder-coat finish.
4. Colors:
   a. Steel: As indicated on finish schedule.

C. Accessory Panels: Manufacturer’s standard electrical and pass through window cutouts, frames and trim.

D. Framing: Steel.

1. Exposed Finish: Factory-applied, baked-enamel or powder-coat finish.
2. Colors: As indicated on finish schedule.

E. Trim: Continuous, factory-finished, snap-on type; adjustable for variations in floor and ceiling levels.

1. Exposed-Metal Trim Finish and Color: Match door frames as indicated on the finish schedule.

F. Doors: Reference Section 08 14 16 “Flush Wood Doors.”

G. Door Frames: Manufacturer's standard steel frames for 1-3/4-inch doors.

1. Frame Finish: Factory-applied, baked-enamel or powder-coat finish.
2. Frame Color: As indicated on finish schedule.

H. Door Hardware: Reference Section 08 71 00 "Door Hardware."

I. Electrical Devices: Integral, concealed raceways to serve electrical power and communication devices indicated on Drawings.
1. 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 OTHER MATERIALS

A. Seismic Bracing: Provide manufacturers standard seismic bracing as required to meet requirements of IBC 2012.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 FABRICATION

A. General: Fabricate demountable walls for installation with concealed fastening devices and pressure-fit members that will not damage ceiling or floor coverings. Fabricate systems for installation with continuous seals at floor, ceiling, and other locations where partitions abut fixed construction.

B. Panels for Unitized-Panel Demountable Partitions: Factory-assembled, flush, unitized-panel construction; with faces smooth and free of buckles, oil-canning, and seams; and insulated with solidly packed, inorganic, mineral filler.

1. Factory glaze panels to the greatest extent possible.

C. Finish Facings: Factory apply finish-facing materials with appropriate backings, using mildew-resistant nonstaining adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install demountable partitions as follows:

1. Install partitions rigid, level, plumb, and aligned. Install seals at connections with floors, ceilings, fixed walls, and abutting surfaces to prevent light and sound transmission.

2. Except for filler panels scribed to fixed walls or columns, do not modify manufacturer's standard components.

3. Install seismic bracing according to manufacturer's recommendations and design to meet seismic requirements.

B. Suspended-Ceiling System: Do not alter suspended-ceiling system.
C. Electrical Devices: Connect integral, concealed wiring to serve electrical power and communication devices indicated on Drawings.

3.2 ERECTION TOLERANCES

A. Install each demountable partition so surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent partitions.

3.3 ADJUSTING

A. Inspect installation, correct misalignments, and tighten loose connections.

B. Remove and replace defaced or damaged components that cannot be satisfactorily repaired.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, assemble, disassemble, and maintain demountable partitions.

END OF SECTION 10 22 19
SECTION 10 22 39 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated, acoustical panel partitions.

1.2 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. STC: Sound Transmission Class.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.


3. Chain-of-Custody Qualification Data: For manufacturer and vendor.

4. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

5. Product Data: For adhesives, indicating that product contains no urea formaldehyde.

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 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- long section of fabric 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 square.
3. Panel Edge Material: Not less than 3 inches long.
4. Hardware: One of each exposed door-operating device.

E. Delegated-Design Submittal: For operable panel partitions.

1. Include design calculations for seismic restraints.

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. 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.

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.

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.

1.6 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.

1.7 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.

1.8 QUALITY ASSURANCE
   A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
   B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
   C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 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.

1.10 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 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.

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 or less.
   b. Smoke-Developed Index: 450 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 complying with NFPA 80, based on testing according to UL 10B for fire-rated door assemblies.

2.2 OPERABLE ACOUSTICAL PANELS

A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
B. Panel Operation: Manually operated, paired 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: Equal widths.

E. STC: Not less than 50.

F. Panel Weight: 12 lb/sq. ft. maximum.

G. Panel Thickness: Not less than 3 inches.

H. Panel Materials:

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
2. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.
3. Adhesives: Do not use adhesives that contain urea formaldehyde.
4. Composite Wood Products: Products shall be made without urea formaldehyde.
5. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
7. Gypsum Board: ASTM C 1396/C 1396M.

I. Panel Closure: Manufacturer's standard unless otherwise indicated.

1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

1. Hinges: Manufacturer's standard.
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. Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track.

C. 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 4 inches 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 no gaps or overlaps. Horizontal butted edges and 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 are indicated, mark facing top and attach facing in same direction.
3. Match facing pattern 72 inches above finished floor.

B. 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. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
2. Color/Pattern: As selected by Architect from manufacturer's full range.

C. Fabric Wall Covering: Manufacturer's standard fabric, from same dye lot, treated to resist stains.
1. Color/Pattern: As selected by Architect from manufacturer's full range.

D. 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 color as selected by Contracting Officer from manufacturer's full range.

2.5 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum 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 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.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

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.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

2.6 ACCESSORIES

A. Work Surfaces:

2. Surface Color: As selected by Architect from manufacturer's full range.
3. Size: Full width and height of panel.
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.
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.

3.3 FIELD QUALITY CONTROL

A. An operable panel partition installation will be considered defective if it does not pass tests and inspections.

B. 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 to operate smoothly and easily, without binding or warping.

C. Verify that safety devices are properly functioning.
3.5 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 10 22 39
SECTIOm 10 20 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Public-use shower room accessories.
   3. Custodial accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
   3. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.
   4. Steel products should contain a minimum of 85 percent recycled content. Preference should be to products with components that are both extracted and manufactured within 500 miles of the project site.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.
1.3 INFORMATIONAL SUBMITTALS
   A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE
   A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.6 COORDINATION
   A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
   B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY
   A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
      1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch 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 minimum nominal thickness.
   D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

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 B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 ACCESSORIES

A. Manufacturer: Item Manufacturer and Model identified in the drawings is basis of design for that particular product. Subject to compliance with requirements, provide toilet accessories by one of the following:

1. Toilet and Bath Accessories:
   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2.3 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 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, 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 recommendations.

END OF SECTION 10 28 00
SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire protection cabinets for the following:
   a. Fire extinguishers.
   b. Rapid entry system.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

D. All test results shall be a required submittal to the Government.

E. Contractor shall submit qualifications of any required Independent Testing and Inspection Agent in advance for Government approval.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

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.

1.5 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

2. Extruded Shapes: ASTM B 221.

B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fire End & Croker Corporation.
   c. Larsen's Manufacturing Company.
   d. Modern Metal Products, Division of Technico Inc.

B. Cabinet Material: Aluminum sheet.

1. Shelf: Same metal and finish as cabinet.

C. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: Manufacturers standard for wall depth.

D. Cabinet Trim Material: Aluminum sheet.
E. Door Material: Aluminum sheet.

F. Door Style: Fully glazed panel with frame.

G. Door Glazing: Tempered float glass (clear).

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide recessed door pull and friction latch.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

I. 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. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

J. Finishes:
   1. Aluminum: Clear anodic.

2.3 RAPID ENTRY SYSTEM

A. Knox Box: Heavy-duty, high-security box that stores keys, access cards, and other small items keyed to a single master key controlled by the local fire department.
   1. Type: Recess mounted with hinged door.
   2. Accessories: Recessed mounting kit (new concrete or masonry construction only).
   3. Color: As selected.

2.4 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 selected.
   1. Fabricate door frames of one-piece construction with edges flanged.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces 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.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed 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.

B. 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 10 44 13
SECTION 10 51 13 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fully-Welded, Heavy-Duty Athletic Lockers (LK-1).
   2. Fully-Welded, Heavy-Duty Athletic Lockers (LK-2).

1.2 SUBMITTALS

A. Product Data: For each type of metal locker and bench.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit MR 5: For products harvested or manufactured within a 500-mile radius of the project site, documentation indicating location of harvesting and manufacturing, and distances from these locations to the project site. Include statement indicating cost for each product documented.
   3. Product data from manufacturers indicating VOC content of any adhesives, sealants, paints, or coatings used documenting compliance with EQ Credit 4.1 and 4.2.
   4. Steel products should contain a minimum of 85 percent recycled content. Preference should be to products with components that are both extracted and manufactured within 500 miles of the project site.

C. Shop Drawings: For metal lockers.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Show locker trim and accessories.
   3. Include locker identification system and numbering sequence.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

E. Product Schedule: For lockers.

F. Qualification Data: For qualified Installer.

G. Warranty: Sample of special warranty.
H. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

I. All test results shall be a required submittal to the Government.

J. Contractor shall submit qualifications of any required independent testing and inspection agent in advance for Government approval.

1.3 QUALITY ASSURANCE

A. Installer qualifications: Manufacturer’s authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain metal lockers and accessories from single source from single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers, locker benches, and accessories from single source from single locker manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B suitable for exposed applications.

B. Fasteners: Zinc or Nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

C. Anchors: Material, type and size required for secure anchorage to each substrate:
   1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as indicated, for corrosion resistance.
   2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 FULLY-WELDED HEAVY-DUTY ATHLETIC LOCKERS (LK-1)

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   1. Art Metal Products.
   2. Lyon Workspace Products, LLC.
   3. Penco Products, Inc.
   5. Spacesaver Corporation

B. Single tier, 18 inches wide by 18 inches deep by 60 inches high in configuration as indicated on the Drawings. At units designated as ABA accessible and adjacent lockers without built-in benches provide taller units with closed channel bases and sloping tops to align with the 60 inch high lockers on the raised bases.

3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.
C. Expanded-Metal Doors: Fabricated from 0.090-inch nominal-thickness expanded metal; welded to 0.105-inch nominal-thickness steel angle frame; with 0.090-inch nominal-thickness, steel sheet lock panel backed by 0.060-inch nominal-thickness, steel sheet retainer welded to door frame. Manufacturer’s standard louvers, minimum six 6 inch louvers top and bottom.

D. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops and Bottoms: 0.060-inch nominal thickness, with single bend at edges.
2. Backs: 0.048-inch nominal thickness.
3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.

E. Unperforated Sides: Fabricated from 0.060-inch nominal-thickness steel sheet.

F. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet or 0.097-inch nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

G. Reinforced Bottoms: Structural channels, formed from 0.075-inch nominal-thickness steel sheet; welded to front and rear of side-panel frames.

1. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.

H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with padlocks; positive automatic latching.

   a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks fabricated from 0.120-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.

I. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

J. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

K. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

L. Continuous Zee Base (at locations without a built-in bench): 4 inches high; fabricated from 0.075-inch nominal-thickness steel sheet.

M. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

N. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.

O. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.

P. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

Q. Finish: Baked enamel or powder coat.
   1. Color: As selected by Architect from manufacturer's full range.

2.5 FULLY-WELDED HEAVY-DUTY ATHLETIC LOCKERS (LK-2)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Art Metal Products.
   2. Lyon Workspace Products, LLC.
   3. Penco Products, Inc.
   4. Republic Storage Systems, LLC.
   5. Spacesaver Corporation

B. Double tier, 18 inches wide by 18 inches deep by 60 inches high in configuration as indicated on the Drawings.

C. Expanded-Metal Doors: Fabricated from 0.090-inch nominal-thickness expanded metal; welded to 0.105-inch nominal-thickness steel angle frame; with 0.090-inch nominal-thickness, steel sheet lock panel backed by 0.060-inch nominal-thickness, steel sheet retainer welded to door frame. Manufacturer’s standard louvers, minimum six 6 inch louvers top and bottom.

D. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
   1. Tops and Bottoms: 0.060-inch nominal thickness, with single bend at edges.
   2. Backs: 0.048-inch nominal thickness.
   3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.

E. Unperforated Sides: Fabricated from 0.060-inch nominal-thickness steel sheet.

F. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet or 0.097-inch nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
G. Reinforced Bottoms: Structural channels, formed from 0.075-inch nominal-thickness steel sheet; welded to front and rear of side-panel frames.
   1. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.

H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
   1. Multipoint Latching: Finger-lift latch control designed for use with padlocks; positive automatic latching.
      a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks fabricated from 0.120-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.

I. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

J. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

K. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

L. Continuous Zee Base: 4 inches high; fabricated from 0.075-inch nominal-thickness steel sheet.

M. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

N. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.

O. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.

P. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

Q. Finish: Baked enamel or powder coat.
   1. Color: As selected by Architect from manufacturer's full range.

2.6 LOCKS
A. Combination Padlocks: Provided by the Government.
2.7 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Equipment: Provide each locker with an identification plate and the following equipment:

D. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.

F. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Single slope at wall units.

H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

I. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

2.8 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

2.9 STEEL SHEET FINISHES

A. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
B. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer’s standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer’s written instructions for application, baking and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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. General: Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.

2. Anchor single rows of metal lockers to walls near top of lockers and to floor.

B. All-Welded Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.

2. Attach door locks on doors using security-type fasteners.

3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

   a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.

2. Attach sloping-top units to metal lockers, with closures at exposed ends.

3. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 13
SECTION 11 24 29 - FALL PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fall arrest system above the aircraft which allows user to walk uninterrupted the entire length of each system and provides secure anchorage to arrest a fall by users. System shall be hands-free, allowing user to work with both hands as if normally traveling along walking surface.

B. Delegated Design:

1. Fall protection systems shall be designed by a Professional Engineer experienced in the design of fall protection systems.
2. Fall protection systems shall be designed for use above C-17 aircraft with up to ten concurrent users (two users on each wing and four users on fuselage), and one on each horizontal stabilizer. Provide two rails above the fuselage with two users on each rail.
3. Dynamic and dead load reactions shall be generated for all intermediate and end supports of the fall protection system.
4. Design all fall protection systems to safely resist the dynamically applied loads while maintaining a safety factor of two against failure.
5. Design of fall protection systems shall be based on the understanding that the underlying structural steel supports are provided as part of the hangar and are adequate to support the imposed loads. Fall Protection loads shall be furnished to the hangar structural engineer of record.
6. Design Engineer shall prepare a fall clearance analysis verifying adequate fall distance to safely stop the worker in the event of a fall.
7. Fuselage and wing horizontal rail shall be designed for two workers falling at a time and each horizontal stabilizer rail shall be designed for one worker falling, with full body harness and shock absorbing lifeline with a maximum arresting force of 900 pounds per worker.
8. The systems shall be designed to be supported by and integral with the hangar. Each anchor location shall be designed to support at least 5,000 pounds.
9. Design Engineer shall coordinate Fall Protection System with mechanical and electrical systems, lighting, fire protection equipment and other components of the hangar.
10. System shall be designed in accordance with ANSI/ASSE Z 359.6 Specifications and Design Requirements for Active Fall Protection Systems.

1.2 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 track system, deceleration devices, trolley, harnesses, and accessories.

2. Include capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: Shop Drawings: Sealed and signed by a licensed professional engineer responsible for preparation of engineering analysis who thereby certifies preparing or supervising preparation of data to comply with specified requirements and recognized engineering principles and practices. Show plans, elevations, sections, and large-scale details indicating coordination with hangar structure, relationships with other construction, and coordination with aircraft clearances. Indicate maximum dynamic and static loads imposed on hangar structure at points of support. Indicate details of adjoining Work, even though not included in Work of this Section, to ensure coordination of Work and Work of other sections. Schedule and describe anchorage assemblies and their related components. Include data for capacity of each type of fastener for its intended use. Reference detail numbers where applicable. At conclusion of installation, provide “Conforming to Construction” set of Shop Drawings.

C. Delegated Design Submittal: Sealed and signed by licensed professional engineer who thereby certifies preparing or supervising preparation of data to comply with specified requirements and recognized engineering principles and practices. Include computations for justification of framing elements or sections, connections including fasteners and welds and anchorage assemblies required to support the fall protection system. Provide loads delivered to hangar.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates: Provide letter signed by manufacturer certifying that the fall protection system components comply with requirements and compliance with contract documents and CFR Part 29 1910.140 with approved drawings and calculations.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fall protection system, to include emergency, operation, and maintenance manuals. Include complete parts list. Include operation and maintenance procedures for proper use and safe operation of equipment.

B. Manufacturer’s Field Reports: Submit Letter of Certification from licensed design engineer indicating completion of operational proof testing on installed system.

C. Training Owner’s Employees: Submit list of attendees at training class in the use, care, and maintenance of fall protection equipment.

1.5 QUALITY ASSURANCE
A. Manufacturer Qualifications: Manufacturer shall have produced fall protection systems similar to those required for this Project full time for no less than 5 years and shall demonstrate successful installations in the last 5 years, free of litigation, injuries or fatalities resulting from their products or design.

B. Installer Qualifications: System manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this project full time for no less than 5 years and demonstrate successful installations in the last 5 years, free of litigation, injuries or fatalities resulting from their products or design.

C. Professional Engineer Qualifications: Professional engineer shall be registered in the manufacturer and be employed by the fall protection manufacturer as a full time fall arrest systems designer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify field measurements and indicate measurements on Shop Drawings to ensure required fit.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's original unopened protective packaging. Store materials, components, and equipment in original unopened protective packaging off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Fall arrest system manufacturer shall provide secondary framing and bracing required to transmit fall protection loads to the hangar structure support points. Fall arrest system shall be designed to protect users while they are attached to track system. In addition to requirements of this Section. System shall be designed for:

1. One simultaneous user per rail over each horizontal stabilizer for a total of 2 users.
2. Two simultaneous users per rail over each wing for a total of 4 users.
3. Four simultaneous users over the fuselage, two on each rail for a total of 4 users.

B. Track System: Single track or dual track fall arrest system, constructed of ASTM A 36/A 36M or ASTM A992/A 992M steel. Components shall be painted safety yellow.

C. Trolley: All steel body compatible with rail system with 360-degree rotating eye.
D. Deceleration Devices: Provide one self-retracting lifeline/lanyard (SRL) for each user for which system is designed. Meet or exceed applicable standards of ANSI Z359.13, 29 CFR Part 1910.140, and meeting the following requirements:

1. Maximum Load: 310 pounds.
2. Weight: 20 pounds.
3. Construction: Heavy duty self-contained, portable, sealed aluminum or stainless steel casing with 3/16-inch minimum stainless steel wire rope, with swiveling safety snap hooks centrifugal braking system.
4. Cable Length: As required to permit personnel to access the SRL from the ground.
5. Fall Arrest Forces: Less than 900 pounds.

E. Harnesses: Provide one harness for each user for which the system is designed. Meet or exceed applicable standards of ANSI Z359.11, and 29 CFR Part 1910.140. Full body harness, lightweight nylon, Class III, approved for fall arrest with back and front “D” ring.


1. Tagline, nylon filament rope. One on each SRL for the purpose of pulling each cable to floor level for hooking up to the harness.
2. As required for complete installation.
3. Snap hooks.
4. Provide three spare self-retracting lifeline/lanyards and three body harnesses.

2.2 MATERIALS

A. Fasteners shall be designed and provided by fall protection system manufacturer. All equipment shall be provided by a single source. All materials shall be new and undamaged. Fasteners shall be designed to support a load on the system of two times the maximum design load without failure. Structural steel supporting members supplied by the fall protection manufacture shall comply with Section 05 12 00 “Structural Steel,” and with AWS D1.1/D1.1M.

2.3 FABRICATION

A. System components shall be of same material unless otherwise indicated. Exposed work shall be true to line and level with accurate angles, surfaces and with straight, square edges. Coordinate anchorage system with hangar structure. Fabricate anchoring devices as recommended by the manufacturer to provide adequate support for intended use.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install according to the approved shop drawings and manufacturer's instructions. Install anchorage and fasteners in accordance with manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this Section. Do not load or stress fall arrest system until all materials and fasteners are properly installed and ready for service. Deform threads of all bolted connections after nuts have been installed and torqued to the proper tension or provide prevailing torque lock nuts.

3.2 FIELD QUALITY INSPECTION

A. Post-Erection Inspection: After erection, Contractor and Contracting Office shall jointly inspect installed system and components to determine compliance with specifications and approved submittals. Systems shall remain out of service until inspection is complete and Letter of Certification has been received by Contracting Officer.

B. Operational Test: After erection and inspection, statically test the fall protection system in service to determine that each component of system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. Rectify deficiencies disclosed by testing and retest system or component to prove that system is fully operational. Any weights required for static proof testing shall be provided by Contractor.

3.3 TRAINING

A. Operator Training: Provide a minimum of one class (four hour minimum) of operator and maintenance training after system has been installed and proof tested. Training is to be for the users and maintainers of the system conducted at the installation site. The Contractor shall submit attendee list.

3.4 CLEANING

A. Remove loose materials, crating, and packing materials from premises.

END OF SECTION 11 24 29
SECTON 12 21 13 – HORIZONTAL LOUVER BLINDS

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. Horizontal louver blinds with aluminum slats.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: For horizontal louver blinds, include fabrication and installation details.
   C. Samples for Initial Selection: For each type and color of horizontal louver blind.
      1. Include Samples of accessories involving color selection.

1.4 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

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. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.
1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CACO, Inc., Window Fashions.
3. Levolor Contract; a Newell Rubbermaid company.
4. Springs Window Fashions; SWF contract.

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.

1. Width: 1 inch.
2. Thickness: Manufacturer's standard.
3. Spacing: Manufacturer's standard.
5. Features:

   a. Lift-Cord Rout Holes: Minimum size required for lift cord and located near back (outside) edge of slat to maximize slat overlap and minimize light gaps between slats.

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose operating mechanisms on three sides.
1. **Capacity:** One blind per headrail unless otherwise indicated.
2. **Ends:** Manufacturer's standard.
3. **Manual Lift Mechanism:**
   a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within blind full operating range.
   b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.
4. **Manual Tilt Mechanism:** Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
   a. Tilt: Full.
   b. Tilt: Two-direction, positive stop or lockout limited at an angle of 60 degrees from horizontal, both directions.
   c. Operator: Dual cord.
6. **Manual Lift Operator and Tilt Operator Locations:** Manufacturer's standard unless otherwise indicated.

D. **Bottom Rail:** Formed-steel or extruded-aluminum tube that secures and protects ends of ladders and lift cords and has plastic- or metal-capped ends.
   1. **Type:** Manufacturer's standard.

E. **Lift Cords:** Manufacturer's standard braided cord.

F. **Ladders:** Evenly spaced across headrail at spacing that prevents long-term slat sag.
   1. **Type:** Cloth tape, manufacturer's standard width.

G. **Valance:** Manufacturer's standard.

H. **Mounting Brackets:** With spacers and shims required for blind placement and alignment indicated.
   1. **Type:** Overhead.
   2. **Intermediate Support:** Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

I. **Hold-Down Brackets and Hooks or Pins:** Manufacturer's standard.

J. **Colors, Textures, Patterns, and Gloss:**
   1. **Slats:** As selected by Contracting Officer’s Representative from manufacturer's full range.
   2. **Components:** Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.
2.3 HORIZONTAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch.

C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.


D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish:

1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
1. Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 12 21 13
SECTION 12 36 23.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic-laminate countertops and backsplashes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate.
   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. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Product Certificates: 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.
   4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
   5. For adhesives, indicating compliance with requirements for low-emitting materials.
   6. Product Data: For installation adhesives, indicating VOC content.
   7. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of cutouts and holes for plumbing fixtures faucets soap dispensers electrical switches and outlets and other items installed in plastic-laminate countertops.
   2. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Initial Selection:
   1. Plastic laminates.

E. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish, with one sample applied to core material.
1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products Certified participant in AWI's Quality Certification Program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

B. Grade: Premium.

C. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

D. Regional Materials: Wood products shall be manufactured within 500 miles of Project site.

E. Certified Wood: Wood products shall be certified as "FSC Pure" according to FSC STD-01-00 and FSC STD-40-004.

F. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Formica Corporation.
      c. Wilsonart.

G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As indicated in the Material Legend.
   2. Grain Direction: Parallel to cabinet fronts.

H. Edge Treatment: Same as laminate cladding on horizontal surfaces.

I. Core Material: Particleboard or Medium-density fiberboard made with exterior glue.

J. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BK L, on underside of countertop substrate.


2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 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. Composite Wood Products: Products shall be made without urea formaldehyde.
2. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.
3. Medium-Density Fiberboard: ANSI A208.2, Grade MD.

2.3 ACCESSORIES

A. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

2.4 MISCELLANEOUS MATERIALS

A. Adhesives: Do not use adhesives that contain urea formaldehyde.

B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

C. Installation Adhesive:

1. Adhesives shall have a VOC content of 70 g/L or less.

2.5 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Contracting Officer 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.

C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Secure backsplashes and side splashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 12 36 23.13
SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Sustainable Design Submittals:

2. Product Data: For adhesives, indicating VOC content.
3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.
1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Avonite Surfaces.
      c. Formica Corporation.
      d. LG Chemical, Ltd.
      e. Wilsonart.

   2. Colors and Patterns: As indicated in the Material Legend.

B. Composite Wood Products: Products shall be made without urea formaldehyde.


D. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.
2. Front: Straight, slightly eased at top.

B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Sidesplashes: 1/2-inch- thick, solid surface material.

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops without joints.

G. Cutouts and Holes:

2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snapping.

G. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16
SECTION 12 48 13 - ENTRANCE FLOOR GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following types of entrance flooring systems:

   1. Floor grids and frame assemblies.

1.2 SUBMITTALS

A. Product data for each type of floor grid and frame specified, including manufacturer's specifications and installation instructions.

B. Shop drawings in sufficient detail showing layout of grid and frame specified including details indicating construction relative to materials, direction of traffic, spline locations, profiles, anchors and accessories.

C. Samples for verification purposes: Submit an assembled section of floor grid and frame members with selected tread insert showing each type of color for exposed floor grid, frame and accessories required.

D. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor grids.

E. All test results shall be a required submittal to the Government.

1.3 QUALITY ASSURANCE

A. Flammability in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/m².

B. Slip resistance in accordance with ASTM D-2047-96, Coefficient of Friction, minimum 0.60 for accessible routes.

C. Standard rolling load performance is 400 lb./wheel with larger loading requirements as specified (load applied to a solid 5 inches by 2 inches wide polyurethane wheel, 1000 passes without damage).

D. Single Source Responsibility: Obtain floor grids and frames from one source of a single manufacturer.

E. Utilize superior structural aluminum alloys 6105-T5 and 6016-T6 for rail components.
1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

1.5 PROJECT CONDITIONS

A. Field measurements: Check actual openings for grids by accurate field measurements before fabrication. Record actual measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

B. Coordinate frame installation with concrete construction to ensure recess and frame anchorage are accurate and that the base is level and flat. Defer frame installation until building enclosure is complete and related finish work is in progress.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design (WM-1): Subject to compliance with requirements provide Construction Specialties, Inc. Model: Pedimat model M1 with tapered aluminum frame and or approved equal from the following:

1. ARDEN Architectural Specialties, Inc.
2. Balco, Inc.
3. J. L. Industries, Inc.
4. Mats, Inc.

B. Basis-of-Design (WM-2): Subject to compliance with requirements provide Construction Specialties, Inc. Model: Pedimat model M1 with aluminum level base frame or approved equal from the following:

1. ARDEN Architectural Specialties, Inc.
2. Balco, Inc.
3. J. L. Industries, Inc.
4. Mats, Inc.

2.2 MATERIALS

A. Aluminum: ASTM B 221, alloy 6105-T5 for rail extrusions and 6061-T6 for key lock bars.
2.3 FLOOR GRIDS

A. Model and Description: Extruded 6105-T5 aluminum alloy. Tread rails with heavy duty carpet inserts shall be joined mechanically by 6106-T6 aluminum alloy, key lock bars. Welding or bolting shall not be permitted. Rail finish shall be heavy-duty powder coat finish.

1. Color as selected from manufacturer’s standard colors.

2.4 GRID FRAMES

A. Base Frame shall be 6063-T5 aluminum alloy with 1/2-inch exposed surface and a depth approximately of 1-13/16-inch. These assemblies receive 1/4-inch thick heavy gauge support cushions 1-inch long mounted to each continuous foot at 20-inches on center.

1. Color of carpet to be selected from manufacturer’s standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which work shall be performed and identify conditions detrimental to proper or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Manufacturer shall offer assistance and guidance to provide a template of irregular shaped grid assemblies to ensure a proper installation.

3.3 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's recommendations.

B. Set grid at height recommended by manufacturer for most effective cleaning action.

C. Coordinate top of grid surfaces with bottom of doors that swing across to provide ample clearance between door and grid.

3.4 CLEANING

A. It is important to the life cycle of the entrance mat that a maintenance schedule be developed which includes regular vacuuming and extraction that correctly matches the amount of traffic the mat incurs.
3.5 PROTECTION

A. After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recess, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of substantial completion.

B. Defer installation of floor grids until time of substantial completion of project.

END OF SECTION 12 48 13
SECTION 21 05 13 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.
B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 21 05 13
SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.
2.4 GROUT


B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."
3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Interior Partitions:

END OF SECTION 21 05 17
SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Escutcheons.
   2. Floor plates.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

   1. Escutcheons for New Piping:
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

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C-17 CORROSION CONTROL / FUEL CELL HANGAR PROJECT
CHARLOTTE-DOUGLAS ANG BASE – CHARLOTTE, NC

ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

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a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Two-piece ball valves with indicators.
   2. Bronze butterfly valves with indicators.
   3. Check valves.
   4. Bronze OS&Y gate valves.
   5. NRS gate valves.
   6. Indicator posts.
   7. Trim and drain valves.

1.2 DEFINITIONS

A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
B. NRS: Nonrising stem.
C. OS&Y: Outside screw and yoke.
D. SBR: Styrene-butadiene rubber.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and weld ends.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.
   a. Level 1: HCBZ - Indicator Posts, Gate Valve.
   b. Level 1: HLOT - Valves.
      1) Level 3: HLUG - Ball Valves, System Control.
      2) Level 3: HLXS - Butterfly Valves.
      3) Level 3: HMER - Check Valves.
      4) Level 3: HMRZ - Gate Valves.

   a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:
   a. Indicator posts.
   b. Valves.
      1) Gate valves.
      2) Check valves.
         a) Single check valves.
      3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B1.20.1 for threads for thread-end valves.
2. ASME B31.9 for building services piping valves.
E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:
   1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
   2. Handwheel: For other than quarter-turn trim and drain valves.
   3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

A. Description:
   1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
   4. Body Material: Forged brass or bronze.
   5. Port Size: Full or standard.
   6. Seats: PTFE.
   7. Stem: Bronze or stainless steel.
   8. Ball: Chrome-plated brass.
   9. Actuator: Worm gear or traveling nut.
   10. Supervisory Switch: Internal or external.
   11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Description:
   1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
   4. Seat Material: EPDM.
   5. Stem Material: Bronze or stainless steel.
   7. Actuator: Worm gear or traveling nut.
   8. Supervisory Switch: Internal or external.

2.4 CHECK VALVES

A. Description:

3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.

2.5 BRONZE OS&Y GATE VALVES

A. Description:

3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.

2.6 NRS GATE VALVES

A. Description:

3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
2.7 INDICATOR POSTS

A. Description:

2. Type: Underground.
3. Base Barrel Material: Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.

2.8 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Description:

   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port size: Full or standard.
   e. Seats: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Handlever.
   i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.

B. Angle Valves:

1. Description:

   b. Body Material: Brass or bronze.
   c. Ends: Threaded.
   d. Stem: Bronze.
   e. Disc: Bronze.
   f. Packing: Asbestos free.
   g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Description:

   c. Ends: Threaded.
   d. Stem: Bronze.
   e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

1. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.
G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 21 05 23
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe-riser resilient supports.
   2. Resilient pipe guides.
   3. Elastomeric hangers.
   4. Restraint channel bracings.
   5. Seismic-restraint accessories.
   6. Mechanical anchor bolts.

1.2 DEFINITIONS


1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction.
      b. Annotate to indicate application of each product submitted and compliance with requirements.
   3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
   1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.

3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.

4. Seismic-Restraint Details:
   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
   d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.
   a. Component Importance Factor: 1.0.
   b. Component Response Modification Factor: 3.
   c. Component Amplification Factor: 3.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.240.
4. Design Spectral Response Acceleration at 1.0-Second Period: 0.103.
5. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction.
   a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

2.3 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post-and-sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.
1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.4 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.5 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.6 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.7 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Piping Restraints:
   1. Comply with requirements in MSS SP-127.
   2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
   3. Brace a change of direction longer than 12 feet.

B. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction that provides required submittals for component.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are
encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer’s recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 21 13 13 “Wet-Pipe Sprinkler Systems” for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days’ advance notice.


4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

END OF SECTION 21 05 48
SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: Red.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

E. Pipe-Label Colors:
   1. Background Color: Safety Red.

2.4 VALVE TAGS
A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
   1. Tag Material: aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
   2. Fasteners: Brass beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS
A. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 by 5-1/4 inches minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

PART 3 - EXECUTION

3.1 PREPARATION
A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.
3.2 GENERAL INSTALLATION REQUIREMENTS
   A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
   B. Coordinate installation of identifying devices with locations of access panels and doors.
   C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION
   A. Install or permanently fasten labels on each major item of mechanical equipment.
   B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION
   A. Piping: Painting of piping is specified in Section 09 91 23 "Interior Painting."
      1. All exposed piping shall be painted and labeled.
   B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
      1. Near each valve and control device.
      2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
      3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
      4. At access doors, manholes, and similar access points that permit a view of concealed piping.
      5. Near major equipment items and other points of origination and termination.
      6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION
   A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.
   B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
1. Valve-Tag Size and Shape:
   a. Wet-Pipe Sprinkler System: 2 inches, square.
   b. Clean-Agent Fire-Extinguishing System: 2 inches, square.

3.6 WARNING-TAG INSTALLATION

   A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 21 05 53
SECTION 21 11 19 - FIRE-DEPARTMENT CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exposed-type fire-department connections.

1.2 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 fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Standard: UL 405.

B. Type: Exposed, projecting, for wall mounting.

C. Pressure Rating: 175 psig minimum.

D. Body Material: Corrosion-resistant metal.

E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

F. Caps: Brass, lugged type, with gasket and chain.

G. Escutcheon Plate: Round, brass, wall type.

H. Outlet: Back, with pipe threads.

I. Number of Inlets: Two.

J. Escutcheon Plate Marking: Similar to "AUTOMATIC SPRINKLER."

K. Finish: Rough brass or bronze.

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 fire-department connections.

B. Examine roughing-in for fire-suppression system to verify actual locations of piping connections before fire-department connection installation.

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

3.2 INSTALLATION

A. Install wall-type fire-department connections.

B. Install two protective pipe bollards on sides of each fire-department connection. Comply with requirements for bollards in Section 05 50 00 "Metal Fabrications."

C. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 21 11 19
SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipes, fittings, and specialties.
   2. Specialty valves.
   5. Pressure gages.
   6. Reduced Pressure Backflow Preventer

1.2 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. System shall be designed, installed, and commissioned in accordance with NFPA 13 and UFC 3-600-01.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Domestic water piping.
   2. HVAC hydronic piping.
3. Items penetrating finished ceiling include the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Fire alarm devices/appliances.

B. Qualification Data: For qualified Installer and professional engineer.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Fire-hydrant flow test report.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and 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. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

   1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

      a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Provide signed/sealed
B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.8 FIELD CONDITIONS

A. Interruption of Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

2. UFC 3-600-01

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Available fire-hydrant flow test records are indicated on the contract drawings.

2. Sprinkler system design shall be approved by authorities having jurisdiction.

   a. Margin of Safety for Available Water Flow and Pressure: 10 percent of the available pressure at system demand flow, including losses through water-service piping, valves, and backflow preventers (i.e. 12 psi backflow preventer pressure loss in accordance with UFC 3-600-01).

   b. Sprinkler Occupancy Hazard Classifications shall comply with design criteria listed in Factory Mutual Data Sheet 3-26, in accordance with UFC 3-600-01:

   1) Electrical Equipment Rooms: Hazard Classification 2.
   2) General Storage Areas: Hazard Classification 2.
   3) Laundries: Hazard Classification 2.
   4) Mechanical Equipment Rooms: Hazard Classification 2.

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Hazard Classification (Light Hazard): 0.10 gpm over 1500-sq. ft. area.
   b. Hazard Classification (Ordinary Hazard, Group 1): 0.20 gpm over 2500-sq. ft. area.
   c. Aircraft Hangar Bay (per UFC 4-211-01): 0.20 gpm over 5,000-sq. ft. area.

4. Maximum Protection Area per Sprinkler: According to UL listing.

5. Maximum Protection Area per Sprinkler:
   b. Hazard Classification (Ordinary Hazard, Group 1): 130 sq. ft.
   c. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

6. Minimum Hose Allowance and Duration:
   a. Hazard Classification (Light Hazard): 250 gpm; 60 minute duration.
   b. Hazard Classification (Ordinary Hazard, Group 1): 250 gpm; 60 minute duration.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight (Schedule 40), Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.


C. Malleable- or Ductile-Iron Unions: UL 860.

D. Fittings must be listed for the anticipated pressure of the system.


F. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick, ASME B16.21, nonmetallic and asbestos free, or EPDM rubber gasket.
   b. Class 150 and Class 300, Ductile-Iron or Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

H. Grooved-Joint, Steel-Pipe Appurtenances:
   1. Pressure Rating: 175-psig minimum.
   2. Painted Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
   3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

I. Installation of cleated (e.g. Uni-Flange) flanges on any piping is prohibited.

2.3 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Riser check valve:
   1. Check valve 2 inches and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 4 inches and larger shall be of the swing type with grooved cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.
   2. Provide threaded outlets for pressure gauges and a drain connection. Provide pressure gauges connected above and below the clapper assembly. Provide a 2-inch main drain valve.

G. Automatic (Ball Drip) Drain Valves:
   3. Type: Automatic draining, ball check.
   5. End Connections: Threaded.
2.4 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved or threaded.

B. Flow Detection and Test Assemblies:

3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

2.5 SPRINKLERS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
   
a. Note that nominal 17/32-inch orifice with Discharge Coefficient K of 8.0 shall be utilize for spaces designated as Hazard Classification 2, in accordance with Factory Mutual Data Sheet 3-26.

D. Sprinkler Finishes: bronze.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   
   1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment, support clip with roll formed threads and retainer.
   2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

F. Sprinkler Guards:
   
   2. Type: Wire cage with fastening device for attaching to sprinkler.

2.6 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Flow Indicators:
   
   3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
   4. Type: Paddle operated.
   6. Design Installation: Horizontal or vertical.

C. Valve Supervisory Switches:
   
   2. Type: Electrically supervised.
   4. Design: Signals that controlled valve is in other than fully open position.
   5. 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.
2.7 PRESSURE GAGES

A. Standard: UL 393.
B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
C. Pressure Gage Range: 0- to 250-psig minimum.
D. Label: Include "WATER" label on dial face.

2.8 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Standard: ASSE 1013 or AWWA C511.
   2. Operation: Continuous-pressure applications.
   3. Pressure Loss: 12 psig maximum, through middle one-third of flow range.
   4. Size: As required by hydraulic calculations.
   5. Design Flow Rate: minimum 500 gpm.
   6. Body Material: Bronze for NPS 2 and smaller; steel with interior lining complying with AWWA C550 for NPS 2-1/2 and larger.
   7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   8. Configuration: Designed for vertical flow.
   9. Accessories:
      a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.9 BACKFLOW PREVENTER TEST HEADER

A. Test header shall be surface type with cast brass body, matching wall escutcheon lettered "Backflow Preventer Test Header" with a polished brass finish. The connection shall have one inlet with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963. Include cap and chain.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.
3.2 SERVICE-ENTRY PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect and Engineer of Record before deviating from approved working plans.

2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions or grooved mechanical couplings adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to outside of building.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

L. Install pressure gages on riser or feed main, at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged
for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

M. Auxiliary drain valves shall be fully accessible and located no higher than 7’-0” above finished floor.

N. Fill sprinkler system piping with water.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 05 18 "Escutcheons for Fire-Suppression Piping."

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

D. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
   1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
G. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open (except for backflow preventer test header which is supervised closed), located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:
   1. Install valves in vertical position for proper direction of flow, in main supply to system.
   2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

3.6 SPRINKLER INSTALLATION

A. Sprinklers installed in suspended ceilings shall be located symmetrically within acoustical ceiling panels.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13. Comply with requirements for identification specified in Section 210553 "Identification for Fire-Suppression Piping."

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

B. Identification and operations identification shall be coordinated with and keyed to the posted operations instruction and the operation and maintenance (O&M) manuals.

C. O&M manuals shall be completed and submitted for approval by no later than 30 days prior to beneficial occupancy.

D. Post instructions for, at a minimum, the following:

1. Comprehensive schematics for sprinkler systems.
2. Facility floor plans showing location of all fire equipment and devices with coordinated identification. Show items such as fire walls, riser, valves, etc.
3. System diagrams, including isometrics of special equipment and systems.
4. Valve charts.
5. Equipment schedule.
6. Wiring diagrams and schematics.

E. Posted Operations instructions shall be framed in heavy gauge extruded metal frames, mounted under glass. These posted instructions shall be water/weather proof. Instructions shall be permanently mounted in the reserved clear wall area (i.e. adjacent to backflow preventer).
F. Posted instructions shall be completed with professionally prepared graphics, printed on full size sheets (minimum 30-inch by 42-inch), and shall be in color. Instructions shall be prepared for all fire protection systems and shall include all components.

G. Provide training for Base personnel on all fire protection systems. Training shall be specified to be completed with all materials, fees, and tuition paid for by the contractor. Employee travel costs shall be paid for by the government.

H. A professional edited DVD for training on all fire protection systems shall be provided. Editing shall include voice-over editing describing features and action of the depicted system.

3.11 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
   1. Standard-weight (Schedule 40), black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:
   1. Standard-weight (Schedule 40), black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. Standard-weight (Schedule 40), black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: Concealed sprinklers.
   4. Spaces Subject to Freezing: Pendent, dry sprinklers.
   5. Special Applications: quick-response sprinklers, unless otherwise noted.

B. Provide sprinkler types in subparagraphs below with finishes indicated.
   1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.

END OF SECTION 21 13 13
SECTION 21 13 16 – PRE-ACTION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. General: This section includes requirements for a single interlock pre-action sprinkler system.

B. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinkler specialty pipe fittings.
5. Sprinklers.
6. Alarm devices.
8. Control panels.

C. Related Sections:

1. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.
2. Section 283114 "Fire Alarm and Mass Notification System" for alarm devices not specified in this Section.

1.2 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Pre-action sprinkler system piping designed to operate at working pressure 175 psig maximum.

1.3 SYSTEM DESCRIPTIONS

A. Single-Interlock Pre-action Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of fire-detection system in same area as sprinklers opens deluge valve, permitting water to flow into piping and to discharge from sprinklers that have opened.

1.4 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Sprinkler system design shall be approved by Contracting Officer's Technical Representative.

   1. Margin of Safety for Available Water Flow and Pressure: 10 percent of required system pressure shall be provided, including losses through water-service piping, valves, and backflow preventers. System design shall be based on available water supply from operation of the fire pump.


   3. Minimum Density for Automatic-Sprinkler Piping Design:

      a. Ordinary-Hazard: 0.2 gpm over entire area of room.

   4. Maximum Protection Area per Sprinkler: Per UL listing.

   5. Maximum Protection Area per Sprinkler: 130 sq. ft

   6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

      a. Ordinary-Hazard Occupancies: 250 gpm

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For pre-action sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

   1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. All ceiling mounted devices in all ceiling types.

E. Qualification Data: For qualified Installer and professional engineer.
F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by Contracting Officer's Technical Representative, including hydraulic calculations if applicable.

G. Fire-hydrant flow test report.

H. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

I. Field quality-control reports.

J. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

K. All test results shall be a required submittal to the Government.

L. Contractor shall submit qualifications of any required Independent Testing and Inspection Agent in advance for Government approval.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

   a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

   1. NFPA 13, "Installation of Sprinkler Systems."

1.7 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in Paragraph 3.11 "Piping Schedule" for applications of pipe, tube, and fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Steel Couplings: ASTM A 865, threaded.

C. Threaded Fittings: ASME B16.4, Class 125, standard pattern.

1. Pressure Rating: 175 psig minimum.
2. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Anvil International, Inc.
b. Victaulic Company.

2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3: Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fivalco Inc.
   b. Global Safety Products, Inc.
   c. Milwaukee Valve Company.

2. Standard: UL 1091.
5. End Connections: Threaded.

D. Iron Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anvil International, Inc.
   b. Fivalco Inc.
   c. Kennedy Valve; a division of McWane, Inc.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Pratt, Henry Company.
   g. Tyco Fire & Building Products LP.
   h. Victaulic Company.

2. Standard: UL 1091.
4. Body Material: Cast or ductile iron.
5. Style: Lug or wafer.

E. Check Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Anvil International, Inc.
b. Fire-End & Croker Corporation.
c. Fire Protection Products, Inc.
d. Fivalco Inc.
e. Globe Fire Sprinkler Corporation.
f. Groeniger & Company.
g. Kennedy Valve; a division of McWane, Inc.
h. Victaulic Company.
i. Viking Corporation.

2. Standard: UL 312
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

F. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. United Brass Works, Inc.

5. End Connections: Threaded.

G. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Valve, Inc.
   b. Clow Valve Company; a division of McWane, Inc.
   c. Crane Co.; Crane Valve Group; Crane Valves.
   d. Crane Co.; Crane Valve Group; Jenkins Valves.
   e. Crane Co.; Crane Valve Group; Stockham Division.
   f. Milwaukee Valve Company.
   g. Mueller Co.; Water Products Division.
   h. NIBCO INC.
   i. Shurjoint Piping Products.
   j. Tyco Fire & Building Products LP.
k. United Brass Works, Inc.

4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

H. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anvil International, Inc.
   b. Fivalco Inc.
   c. Kennedy Valve; a division of McWane, Inc.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Tyco Fire & Building Products LP.
   g. Victaulic Company.

2. Standard: UL 1091.
4. Valves NPS 2 and Smaller:
   a. Valve Type: Ball or butterfly.
   b. Body Material: Bronze.
   c. End Connections: Threaded.

5. Valves NPS 2-1/2 and Larger:
   a. Valve Type: Butterfly.
   b. Body Material: Cast or ductile iron.
   c. End Connections: Flanged, grooved, or wafer.


I. NRS Gate Valves:

1. Manufacturers: Subject to compliance with requirements acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Valve, Inc.
   b. Clow Valve Company; a division of McWane, Inc.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. Kennedy Valve; a division of McWane, Inc.
   e. Mueller Co.; Water Products Division.
   f. NIBCO INC.
g. Tyco Fire & Building Products LP.

5. Stem: Nonrising.
6. End Connections: Flanged or grooved.

2.4 TRIM AND DRAIN VALVES

A. General Requirements:

2. Pressure Rating: 175 psig minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fire Protection Products, Inc.
   b. United Brass Works, Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Anvil International, Inc.
   b. Fire-End & Croker Corporation.
   c. Fire Protection Products, Inc.
   d. Kennedy Valve; a division of McWane, Inc.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Potter Roemer.
   h. Tyco Fire & Building Products LP.
   i. Victaulic Company.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Fire Protection Products, Inc.
   b. United Brass Works, Inc.
2.5 SPECIALTY VALVES

A. General Requirements:

2. Pressure Rating:
   a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Deluge Valves:

1. Manufacturers: Subject to compliance with requirements acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFAC Inc.
   b. CLA-VAL Automatic Control Valves.
   d. Reliable Automatic Sprinkler Co., Inc.
   e. Tyco Fire & Building Products LP.
   f. Victaulic Company.
   g. Viking Corporation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
5. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
6. Air-Pressure Maintenance Device:
   a. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1) AFAC Inc.
      2) Globe Fire Sprinkler Corporation.
      3) Reliable Automatic Sprinkler Co., Inc.
      4) Tyco Fire & Building Products LP.
      5) Venus Fire Protection Ltd.
6) Victaulic Company.
7) Viking Corporation.

c. Type: Automatic device to maintain minimum air pressure in piping.
d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.

7. Air Compressor:

a. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1) Gast Manufacturing Inc.
   2) General Air Products, Inc,
   3) Viking Corporation.

d. Power: 120-V ac, 60 Hz, single phase.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFAC Inc.
   b. Reliable Automatic Sprinkler Co., Inc.
   c. Tyco Fire & Building Products LP.

4. Type: Automatic draining, ball check.

2.6 SPRINKLER SPECIALTY PIPE FITTINGS

A. General Requirements for Dry-Pipe-System Fittings: UL listed for dry-pipe service.

B. Branch Outlet Fittings:
1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Anvil International, Inc.
   b. National Fittings, Inc.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.

5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.

4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   b. Fire-End & Croker Corporation.
   c. Potter Roemer.

2. Standard: UL 199.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AGF Manufacturing Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.7 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFAC Inc.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Victaulic Company.

B. General Requirements:


C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with discharge coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:
1. Chrome plated.
2. Bronze.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.

F. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFAC Inc.
   b. Potter Electric Signal Company.
   c. System Sensor; a Honeywell company.
   d. Tyco Fire & Building Products LP.
   e. Viking Corporation.

3. Type: Electrically supervised water-flow switch with retard feature.
5. Design Operation: Rising pressure signals water flow.

C. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Fire-Lite Alarms; a Honeywell company.
b. Kennedy Valve; a division of McWane, Inc.
c. Potter Electric Signal Company.
d. System Sensor; a Honeywell company.

3. Type: Electrically supervised.
5. Design: Signals that controlled valve is in other than fully open position.

2.9 MANUAL CONTROL STATIONS

A. Description: UL listed or FM Global approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.10 CONTROL PANELS

A. Description: FM Approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.

B. Power Requirements: 120/240-V ac; with electrical contacts for connection to system components and fire-alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.

C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.

1. Mounting: Recessed flush with surface.

D. Supervised Circuits: Separate circuits for each independent hazard area.

1. Detection circuits equal to the required number of zones, or addressable devices assigned to the required number of zones.
3. Alarm circuit.
5. Abort circuit.
6. EPO circuit.

E. Control-Panel Features:

1. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
2. Automatic switchover to standby power at loss of primary power.
3. Storage container, low-pressure indicator.
4. Service disconnect to interrupt system operation for maintenance with visual status indication on the annunciator panel.
F. Standby Power: Sealed lead calcium batteries with capacity to operate system for 24 hours and alarm for minimum of 15 minutes. Include automatic battery charger that has a varying charging rate between trickle and high depending on battery voltage, and that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, automatic transfer switch, and suitable enclosure.

2.11 DETECTION DEVICES
A. Photoelectric smoke detectors are connected to the building fire alarm system. Clean-agent system shall be activated by addressable control modules by the building fire alarm system.
B. Signals to the Central Fire Alarm Control Panel: Any type of local system trouble is reported to the central fire alarm control panel as a composite "trouble" signal. Alarms on each system zone are individually reported to the central fire alarm control panel as separately identified zones.

2.12 MANUAL RELEASE STATIONS
A. General Description: Semi-recessed FM Approved or NRTL listed, with clear plastic hinged cover, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
B. Manual Release: "MANUAL RELEASE" caption, and red finish. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
C. Abort Switch: "ABORT" caption, momentary contact, with green finish.

2.13 SWITCHES
A. Description: FM Approved or NRTL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
   1. Low-Agent Pressure Switches: Pneumatic operation.
   2. Power Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.
   3. Door Closers: Magnetic retaining and release device or electrical interlock to cause the door operator to drive the door closed.

2.14 ALARM DEVICES
A. Description: Listed and labeled by an NRTL or FM Approved, low voltage, and surface mounting. Comply with requirements in Section 28 31 14 "Fire Alarm and Mass Notification System."
B. Horns: 90 to 94 dBA.
C. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

2.15 ELECTRICAL POWER AND WIRING
A. Electrical power, wiring, and devices are specified in Division 26.

2.16 PRESSURE GAGES
A. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AMETEK, Inc.; U.S. Gauge Division.
   2. Ashcroft, Inc.
   4. WIKA Instrument Corporation.
B. Standard: UL 393.
C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
D. Pressure Gage Range: 0 to 250 psig minimum.
E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION
A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in paragraph 1.6 "Quality Assurance".
B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING
A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 221113 "Facility Water Distribution Piping."
3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from Contracting Officer's Representative. File written approval with COTR before deviating from approved working plans.

B. Piping Standard: Comply with requirements in NFPA 13 for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or to outside building.

K. Connect compressed-air supply to dry-pipe sprinkler piping.

L. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

M. Install alarm devices in piping systems.

N. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.

O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
P. Drain pre-action sprinkler piping.

Q. Pressurize and check pre-action sprinkler system piping and air compressor.


3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and Contracting Officer's Technical Representative.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:
   1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
   2. Deluge Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
      a. Install air compressor and compressed-air supply piping.
      b. Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
      c. Install compressed-air supply piping from building's compressed-air piping system.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Do not install pendant or sidewall, wet-type sprinklers in areas subject to freezing.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safety equipment. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from sprinklers.
B. Remove and replace sprinklers with paint other than factory finish.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain specialty valves.

3.11 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
B. Standard-pressure, pre-action sprinkler system, shall be the following:
   1. Standard-weight Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: Dry-pendent concealed sprinklers.
B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
3. Upright Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.

END OF SECTION 21 13 16
SECTION 21 13 25 - HIGH EXPANSION FOAM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Design and provide a new automatic low-level high expansion foam fire extinguishing system, including electronic detection, control, and release systems, as indicated on drawings. Systems shall provide uniform distribution of high expansion foam solution to provide complete coverage over the protected area as indicated on drawings. System shall be balanced to operate both independently and with simultaneous operation of the overhead sprinkler system specified in Section 21 13 13 “Wet Pipe Sprinkler System.”

B. The electronic detection, control, and release system shall include wiring, raceways and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

C. The design, equipment, materials, installation, and workmanship shall be in strict accordance with UFC 3-600-01, UFC 4-211-01, NFPA 11, NFPA 13, NFPA 70, and NFPA 72, except as modified herein. Each system shall include all materials, accessories and equipment necessary to provide each system complete and ready for use. Design and install each system to give full consideration to blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to provide complete coverage in accordance with the drawings to be submitted for approval. Devices and equipment for fire protection service shall be of a make and type listed by a Nationally Recognized Testing Laboratory unless otherwise specified.

D. Furnish piping offsets, fittings, and any other accessories as required to provide a complete installation and to eliminate interference with other construction. Design any portions of the system that are not indicated on the drawings, including locating and sizing piping and equipment when this information is not indicated on the drawings or is not specified herein.

E. The design of the system shall be based on hydraulic calculations, and the other provisions specified herein.

F. The Contractor is responsible for the installation, testing, and acceptance testing of the high expansion foam system as required by this specification and the plans. The contractor is also responsible for portions of the design per this specification and the plans.

1.2 PRECONSTRUCTION SUBMITTALS

A. Environmental Protection: Submit high expansion foam solution containment and disposal plan as required under paragraph entitled “Environmental Protection.”
1.3 ACTION SUBMITTALS

A. Product Data: For each of the following products, Manufacturer's catalog data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list with equipment description, model number, and quantity shall be provided.

1. Pipe, fittings, and mechanical couplings
2. Valves, including gate, check, and globe
3. Pipe hangers and supports
4. Pressure switch
5. Surge Arrester
6. Terminal cabinets/assemblies
7. Storage batteries
8. Annunciator panel
9. High expansion visual alarm
10. Battery charger
11. Trench Drainage Diverter Valve Controls
12. Surge Analysis
13. Foam Generators
14. Foam Generator Spread Curves
15. Seismic Protection
16. Water Tight Junction Boxes
17. Foam/Water Flow Control Valves
18. Strainer
19. Foam Concentrate Jockey Pump
20. Foam/Water Proportioning System
21. Foam Concentrate
22. Foam Proportioner
23. Double Wall Foam Concentrate Tank
24. Manual Foam Releasing Stations
25. Manual Foam Stop Stations
26. Releasing Service Fire Alarm Control Unit (RSFACU)
27. Optical Flame Detectors and Controller
28. Listing or Approval of Equipment
29. Surge arrestors
30. Materials and Equipment

B. Spare Parts: Spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

C. Proposed Diagrams and Instructions: A copy of the proposed diagrams and instructions for the overall foam system, prior to posting.

D. Design Data:
1. Foam Delivery calculations: Submit foam delivery calculations demonstrating foam solution is delivered to the most remote high expansion generator within 30 seconds of system activation.

2. Pressure discharge graphs or tables: Submit pressure discharge graphs or tables showing pressure discharge relationship for discharge nozzles.

3. Battery standby power requirements calculations:
   a. Substantiating battery standby power requirements calculations showing battery capacity, supervisory and alarm power requirements.
   b. Provide complete battery calculations for both the alarm and supervisory power requirements. Ampere hour requirements for each system component shall be submitted with the calculations.

4. System hydraulic surge analysis: System hydraulic transit (surge) analysis showing hydraulic transit pressure occurring throughout the system at both design flow and non-flow conditions.

5. Hydraulic Calculations: Provide hydraulic calculations complying with the requirement of this Section and Section 21 13 13 “Wet Pipe Sprinkler System.” Calculations shall be signed and sealed by a qualified professional engineer.

6. Foam Spread/Coverage Calculations: Provide the following calculations/information to verify that the design meets the requirements shown on the plans:
   a. Provide liquid travel time in seconds from the Foam/Water Flow Control Valve to each foam generator.
   b. Provide Hi-Ex foam spread time from each foam generator in accordance with foam equipment manufacturer's recommendations for foam spread time.
   c. Provide total time to meet the design criteria.
   d. Provide calculations for liquid travel time and foam spread time indicated above.
   e. Provide a sketch showing locations of Foam/Water Flow Control Valve. Show pipe diameters, length of associated pipe, and travel time in seconds.
   f. Provide a full size to-scale drawing with the aircraft silhouette, foam generators and foam-spread diagrams at one-minute elapsed time from the activation of a manual foam discharge station.
   g. Include the requested information in a tabular form on the Foam Spread Drawing.
   h. Note that the "One Minute or Less" coverage requirement starts at the actuation of manual foam discharge station.

E. Shop Drawings: Prepare shop drawings for High Expansion Foam Systems in accordance with the requirements for "Plans" as specified in NFPA 11, "Working Plans" as specified in NFPA 13, and "Shop Drawings" as specified in NFPA 72. Each drawing shall be 24 by 36 inches. Unless otherwise noted, floor plans shall be drawn to a scale not less than 1/8" = 1'-0". Show data essential for proper installation of each system. Show details, plan view, elevations and sections of the systems supply and piping. Show piping schematic of systems supply, devices, valves, pipe and fittings. Show point to point electrical wiring diagrams. Submit drawings stamped by the Qualified Fire Protection Engineer.
1. Do not commence work until the design of each system and the various components have been approved. Show:
   a. Room, space or area layout and include data essential to the proper installation of each system
   b. Sprinkler heads, discharge nozzles and system piping layout annotated with reference points for design calculations
   c. Field wiring diagrams showing locations of devices and points of connection and terminals used for all electrical field connections in the system, with wiring color code scheme
   d. Optical flame detector manufacturer's recommended detector layout (plan view) including horizontal and vertical angles for correct aiming.

2. Provide three copies of the high expansion foam system shop drawings, no later than 21 days prior to the start of sprinkler system installation.

3. Do not commence work until the design of each system and the various components have been approved. Show:
   a. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions in accordance with symbols shown in NFPA 170 used in the package.
   b. Floor plans drawn to a scale not less than 1/8 inch equals 1 foot clearly showing locations of devices, equipment, risers, electrical power connections, areas covered by each generator, and other details required to clearly describe the proposed arrangement.
   c. Piping plan for high expansion foam system incorporating that shown. Generators and associated piping shall be shown. Abbreviated presentation forms will not be accepted. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be identified. A separate plan shall be provided for each overhead sprinkler system and each foam system.
   d. Piping plan and isometric drawing of the concentrate system and details of all associated valves, fittings, and other components. Drawing shall incorporate that shown.
   e. Shop drawings of each inductor. Shop drawings must be accompanied with an inductor datasheet fully annotated with the flow rate, inlet pressure, back pressure, inlet K-factor, and outlet K-factor to which the inductor will be calibrated.
   f. Location of control panels, detectors, manual stations, supervisory switches, solenoids, notification appliances, and other electrical devices. Conduit routing and sizes, and the number of conductors contained in each shall be indicated. For optical flame detectors provide a plan with the cone-of-visions and respective aim points. Provide elevation showing cone-of-visions and respective aim points demonstrating that the cone-of-visions do not extend more than 5 feet outside the hangar doors.
   g. Longitudinal and transverse building sections showing typical pipe routing and elevation above finished floor.
   h. Equipment room layout drawings drawn to a scale of not less than inch equals 1 foot to show details of each system component, clearances between each other and from other equipment and construction in the room.
i. Details of each type of pipe hanger, sway bracing for earthquake protection restraint of underground water main at point-of-entry into the building, proportioners, foam generators, foam tanks, and mounting details, foam system control valve header and related components. Include bracing for foam generators and foam tanks.

j. Details of all components required for support of the sprinkler piping from the building structural system, including hangers and bracing, and details of all connections to the components of the metal building system. Provide plans, elevation drawings, and details as required to fully convey the clearances required for the floor and wall penetrations.

k. Connection drawings and control diagrams indicating overall mechanical operation of the high expansion system. This shall include identification and operation of each major component of the system. Diagrams shall be supplemented with a narrative description of the system. Indicate foam system control panel, make and model of devices and equipment to which the system is connected.

l. Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems which are supervised or controlled by the system. Diagrams shall show connections from field devices to the Releasing Service Fire Alarm Control Unit (RSFACU) and remote foam system control units, initiating circuits, switches, relays and terminals.

m. Field wiring diagrams showing locations of devices and points of connection and terminals used for all electrical field connections in the system, with wiring color code scheme

n. Interfacing with fire suppression control components shall be clearly indicated on drawings. Solenoids shall be FM approved for release by the releasing panel.

o. Optical flame detector manufacturer's recommended detector layout (plan view) including horizontal and vertical angles for correct aiming.

p. Details of each foam generator and mounting details, high expansion foam system control valve header and related components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: The name and documentation of certification of the proposed Fire Protection Specialists and Qualified Fire Protection Engineer (QFPE), no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

B. Installers Qualifications: Data approved, prior to submittal of any other data or drawings, to substantiate that the proposed installer is regularly engaged in the installation of the type and complexity of fire protection system included in this project. Data shall identify the location of three systems recently installed by the proposed installer which are comparable to the system specified. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1. Prior to commencing work, submit data showing that the Contractor has successfully installed automatic high expansion foam fire extinguishing systems of the same type and
design as specified herein, or that he has a firm contractual agreement with a subcontractor having the required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system, and certify that the system has performed satisfactorily for a period of at least 18 months.

2. The installer shall be experienced and regularly engaged in the installation of the type and complexity of fire protection system included in this project. A statement prior to submittal of any other data or drawings, that the proposed installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the locations of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

C. Post-discharge Test Requirements: Details of method proposed for required tests at Final Acceptance, including step-by-step test procedures; list of equipment to be used; names, titles, and affiliations and qualifications of personnel who will participate in the tests; methods for protecting the facility and equipment during testing; means for containing the foam solution during discharge tests; and proposed means for disposal. Test plan shall include a drawing showing proposed number and arrangement of fire hoses and nozzles proposed for use in testing foam proportioners. Blank forms the Contractor plans to use to record test results shall be included. Provide completed Preliminary Acceptance Test (PAT), and Final Acceptance Test (FAT) checklists. See paragraph in this specification with checklist items.

D. Certificates for Installer: Submit installer and systems technician qualifications as required under paragraph entitled Qualifications of Installer.

E. Materials and Equipment Certificates: Certificates from manufacturers to substantiate that components, equipment and material proposed for installation and use meet requirements as specified, concurrent with submittal of manufacturer's catalog data of equipment proposed for installation. Certificates shall be on a form for this purpose or on official letterhead of the manufacturer with specified information stated as required. Certificate shall be signed by an officer of the corporation. Certificates shall be provided for the following:

1. Foam concentrate. Certification that concentrate proposed for use has been tested and is in compliance with approved specifications.
2. Concentrate control valve. Certification that the valve is designed and, constructed as specified and will function as intended.
3. Proportioning system. Certification that the foam proportioning system complies with contract specifications and manufacturer's recommendations.
4. Control panel. Certification that the control panel releasing module is electrically compatible with the electrically-actuated automatic water control valve.
5. Gaskets. Certification from the foam manufacturer that the foam concentrate and foam/water solution is compatible with all gasket materials that it will contact in this system.
6. Foam Containment and Disposal Plan.
7. Compliance with foam system control panel ground fault detection requirement.
F. Material and Equipment Qualifications: Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1. Alternative Qualifications: Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

2. Source Limitations: Obtain foam concentrate, proportioning system, foam generators, and major accessories through one source. All components shall be listed for use together as single system.

3. Product Options: Drawings indicate size, profiles, and dimensional requirements of foam fire-extinguishing systems and are based on the specific system indicated. Other manufacturers' foam fire-extinguishing systems complying with requirements may be considered.

4. Code Compliance: Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

5. NFPA Compliance: Fabricate and label foam fire-extinguishing systems to comply with NFPA 11, except where contract documents provide specific criteria which is different than NFPA.

1.5 SUBMITTAL PREPARER’S QUALIFICATIONS

A. Fire Protection Specialist: The Fire Protection Specialist has obtained National Institute for Certification in Engineering Technologies, Automatic Sprinkler Systems, Level III certification or Special Hazards Suppression Systems, Level IV certification, as applicable to the project. Shop drawings and calculations must be prepared by this Fire Protection Specialist. The QFPE must review the shop drawings, hydraulic calculations and material submittals. The shop drawings must bear the Review Stamp of the QFPE prior to submitting the fire extinguishing system shop drawings.

B. Qualified Fire Protection Engineer (QFPE): An individual who is a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience.

1.6 CLOSEOUT SUBMITTALS

A. Test Plan: Test plan shall be complete in describing what measurements are to be made and how they will be collected. Include copies of proposed data collection forms and test reports. Clearly describe what tests are to be conducted, what data is to be collected, acceptable findings, corrective action for failure to meet acceptable findings, equipment required, personnel required, notification procedure for notifying contracting officer, list of manufacturers
employees to assist, integration of test for sprinkler systems, fire pumps, high expansion foam, and fire alarm systems. Verify that the fire pumps are adequate to support the fire protection systems.

1. Provide an initial test plan with test procedures 60 days prior to final acceptance test. Include the following information:
   a. Schedule of tests for each day, Example: Day 1, Day 2, Day 3 etc.
   b. List of tests.
   c. Blank forms for recording test data for each test.
   d. Test procedure for each test.
   e. List of equipment required for each test.
   f. Calibration certificate for testing equipment

2. Submit the preliminary acceptance test report to the Contracting Officer and AHJ before requesting a Final Acceptance Test. Provide the preliminary acceptance test report, digital recording or videotape of the preliminary test, a “Punch List” (list of deficiencies prepared at the completion of preliminary test), and a Final Acceptance Test plan 15 days prior to final acceptance test

3. Provide the Final Acceptance Test Report within 15 days after the completion of the Final Acceptance Test. Provide the final acceptance test report in booklet form showing field tests performed with the digital or video of the final test to document compliance with the specified performance criteria.

4. Provide documentation of readings, test results, and indicate the final position of control valves. Include all required Final Acceptance Test NFPA forms. The Final Acceptance Test report shall include the resolution of punch list items developed during preliminary acceptance testing.

5. Reports for tests, as follows:
   a. Reports as outlined in NFPA 13 documenting results of flushing and hydrostatic tests.
   b. Trip tests of wet pipe sprinkler system and foam deluge system.
   c. Test report of foam concentrate proportioning system. Report shall include all pressure readings and settings of system components. Report shall include conductivity readings for foam samples taken from the high expansion foam proportioner. Report shall be signed by the factory-trained technical representative employed by the foam concentrate manufacturer.
   d. Test report of the foam system control panel and initiating and indicating devices. Report shall include a unique identifier for each device with an indication of test results. Report shall be signed by the factory-trained technician employed by the control panel manufacturer.
   e. Video of tests specified to be recorded.

B. Operation and Maintenance Manuals: Manuals in loose-leaf binder format and grouped by technical sections consisting of manufacturer's brochures, schematics, printed instructions, general operating procedures, and safety precautions. Manuals shall include a narrative description of the sequence or sequences of operation of the overall fire protection system and a
separate description for each major subsystem. Information to be provided shall include specific settings for all adjustable valves. The manuals shall list routine maintenance procedures, possible breakdowns, and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout, and simplified wiring and control diagrams for the system as installed. The manuals shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

C. Record-Drawings (As-Built Drawings): For Fire Extinguishing System, one set of reproducible and six copies, within 14 calendar days after successful completion of required testing. A separate set of approved submittal drawings of the overall system, marked up to indicate as-built conditions, shall be maintained on site. These drawings shall be maintained in a current condition at all times and shall be made available for review immediately upon request during normal working hours. Variations from the approved drawings, for whatever reason, including those occasioned by modifications, change orders, optional materials, and/or required for coordination between trades shall be indicated in sufficient detail to accurately reflect the as-built conditions.

D. Video Tape of Preliminary and Final Hi-Ex foam discharge test.

E. Spare Parts: Furnish the following spare parts:

1. Two of each type of detector installed (including two optical flame detectors).
2. One of each type notification appliance installed.
3. Four of each type of fuse required by the system.
4. One each foam system manual start station and stop station
5. One fire alarm manual pull station
6. Six complete sets of system keys. Keys must be CAT 60.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Foam application must be from foam generators providing not less than a 700:1 expansion ratio by aeration specified herein and as indicated on the drawings. Design must be such that foam solution must begin discharging at the most remote foam nozzle within 30 seconds from system activation. Submit foam delivery calculations demonstrating compliance.

B. Cover 90 percent of the aircraft’s projected silhouette on the floor with high expansion foam within 60 seconds upon system actuation (e.g. manual foam pull station). For fixed winged aircraft, the areas under engines extending beyond the wing edge and under the rear elevators are not considered part of the silhouette for this compliance criterion. For rotary winged aircraft, the rotor sweep is considered part of the silhouette for this compliance criterion.
C. Additionally, cover the aircraft servicing area and adjacent floor areas not cut-off from the hangar bay (e.g. self-closing or automatically closing doors/shutters) with high expansions foam to a depth of 3.2 ft. (1 meter) within four minutes.

D. Rate of Foam Discharge: The rate of discharge shall be as shown on the drawings.

E. Foam Concentrate Proportioning System: Foam proportioning must be by a foam inductor taking suction from an atmospheric high expansion foam concentrate storage tank located directly beneath/adjacent the inductor.

F. Concentrate and Water Supply: System must apply foam solution over the protected area for a minimum of 15 minutes while simultaneously discharging water through the overhead wet pipe sprinkler system specified in Section 211313 WET PIPE SPRINKLER SYSTEM. Reduction of the discharge duration based on a discharge rate higher than the specified minimum is not permitted.

G. Activation: System activation must be controlled by an addressable foam system control panel listed for releasing service.

H. The following will activate the low-level high-expansion foam systems:
   1. Manual foam activation stations located as shown on drawings.
   2. The cross-zoning of two optical flame detectors in the hangar bay is required to automatically release the high expansion foam. Actuation of the fire sprinkler system shall not activate the high expansion foam system. The first optical flame detector shall activate the general fire alarm, and report to the fire department. The second optical flame detector shall activate the foam system, and report to the fire department.

I. Hydraulic Calculations: Design of low-level high expansion foam systems must be by hydraulic calculations for uniform distribution of HIGH EXPANSION FOAM solution over the protected area as defined on the drawings and must conform to the NFPA standards listed above and to the requirements specified herein.

J. Base hydraulic calculations on the operation of the minimum number of pumps running necessary to supply the high-expansion generators and the sprinkler design area. Pumps are specified under Section 21 31 13 Electric-Drive, Centrifugal Fire Pumps.

K. Hydraulically design the system as follows:
   1. Calculations must include pressure discharge graphs or tables showing pressure discharge relationship for foam generators. Design must be such that operating pressure of foam solution nozzles is maintained between (the foam generator's manufacturer's minimum operating pressure +5 psig and the foam generators' manufacturer's maximum operating pressure -10 psig during system discharge. Hydraulic calculations must assume a minimum 20 psi pressure loss for the flow control valve or the minimum pressure loss.
necessary for flow/pressure regulation as published by the manufacturer's literature, whichever is greater. Include "Demand Calculations" and "Supply Calculations".

2. Provide a combined hydraulic demand calculation of the foam/water system based on the foam generator output, water flows, and pressure, and the most hydraulically demanding area of the sprinkler system in the hangar bay. Demonstrate the combined fire water demand calculation does not exceed the available fire water supply. Confirm that the resulting foam/water demand from this calculation does not exceed the quantity of foam concentrate shown on the plans.

3. Provide a foam spread calculation/diagram demonstrating the performance requirements to cover the aircraft silhouette are met within one minute. This calculation method is a reasonable approach to demonstrate the design meets the performance requirements, but does not take all aspects into consideration. This calculation method does not remove the obligation to demonstrate system compliance during testing. Include the following parameters in determining the maximum foam spread after one minute:

   a. Time for the RSFACU to open the flow control valve after initiation of the manual foam releasing station.
   b. Time for the foam/water reach the each generator based on the piping velocities in the hydraulic supply calculation.
   c. Time for the foam to reach the floor of the hangar bay after discharging from the generator based on the height and orientation of each generator.
   d. Time for the foam to spread across the floor based on the manufacturer's foam spread diagrams, or at a rate not to exceed 1 ft. /sec.
   e. Hydraulically design the sprinkler system to provide 0.2 gpm/sq. ft. over the hydraulically most demanding 5,000 sq. ft. in the hangar bay. Do not increase design area for sloped ceilings.

L. Flow Control Valves: Water flow thru the foam concentrate proportioning system and to the foam generator system must be controlled by flow control valves. Flow control valves must be listed and include control of the opening and closing speed of the valve, provide pressure regulation to the discharge devices, and provide for remote resetting of the valve. Foam proportioning equipment shall activate automatically upon tripping of the flow control valve for the corresponding foam system. The flow control valve shall be tripped by independent detection systems. No valve will be operated by the building fire evacuation and alarm system. Use of motor-operated valves is prohibited. Once activated, the system shall remain activated until reset manually, however, foam flow may be interrupted/stopped momentarily by depressing and holding the "foam stop" button strategically placed on the hangar bay walls as shown on the plans.

M. Flow control valves shall be operated by an addressable foam system control panel listed for releasing service.

N. Hose System: Hose systems including hose reels shall not be provided.

O. Surge Analysis: Manufacturer's calculations are required for determining the minimum surge arrestor capacities where the following distances are exceeded from the fire pump discharge to
the most remote dry-pipe, pre-action, or foam/water riser. Include the surge arrestor calculations performed by the manufacturer in the design calculations.

1. 1,500 feet for a system not exceeding a working pressure of 175 psi.
2. 1,000 feet for a system not exceeding a working pressure of 250 psi.
3. 500 feet for a system not exceeding a working pressure of 175 psi, and plastic piping is used (e.g. PVC, HDPE).
4. 300 feet for a system not exceeding a working pressure of 250 psi, and plastic piping is used (e.g. PVC, HDPE).

P. A surge protection analysis shall study the entire fire suppression system, including the foam water system, sprinkler system, site piping, fire pumps, and reservoirs using commercially available software. The study shall determine the pressure surges or water hammer due to pump starting and stopping, valves opening and closing, and foam water initially reaching the foam generators. The study shall consider fire water pumps starting when foam system is activated. The study shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall have performed such a study for at least three similar systems, that have performed in the manner intended for a period of not less than 6 months. Submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of the study. This includes aboveground and underground pipe.

Q. Protection of System Against Earthquake Damage: Seismically protect the system against damage from earthquakes. Install the seismic protection of the system components and piping, including sway bracing as required, in accordance with UFC 3-310-04, NFPA 13 and Annex A. Submit load calculations for sizing of sway bracing, for systems that are required to be protected against damage from earthquakes. Include the required features identified therein that are applicable to the specific piping system.

R. Calculations: Submit design calculations for the system:

1. Hydraulic calculations showing basis for design in accordance with NFPA 11 and NFPA 13.
2. Pressure discharge graphs or tables showing pressure discharge relationship for sprinkler heads and discharge nozzles.
3. Substantiating battery standby power requirements calculations showing battery capacity, supervisory and alarm power requirements.
4. System surge analysis showing surge pressure occurring throughout the system at both design flow and non-flow conditions.

2.2 MATERIALS

A. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE
A. All equipment and material shall be listed by a Nationally Recognized Testing Laboratory (NRTL) unless otherwise noted in this section or referenced standards.

2.4 PRESSURE RATINGS

A. Valves, fittings, couplings, proportioners, alarm switches, strainers, and similar devices shall be rated for the maximum working pressures that can be experienced in the system, but in no case less than 175 psi.

2.5 NAMEPLATES

A. Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

2.6 ABOVEGROUND PIPING SYSTEMS HANDLING WATER OR FOAM SOLUTION

A. Pipe:

1. Pipe shall be standard weight conforming to ASTM A 53/A 53M. Pipe shall be Schedule 40. Pipe shall be marked as to the brand or name of the manufacturer, kind of pipe and the ASTM designation in accordance with the "Product Marking" provisions of the ASTM standard. Do not use galvanized piping for foam-water system piping.
2. Rubber gaskets used with grooved-end fittings shall be UL listed for use in dry-pipe sprinkler systems. Use of restriction orifices, reducing flanges, and plain-end fittings with mechanical couplings (which utilize steel gripping devices to bite into the pipe when pressure is applied) are not permitted.
3. Provide listed/approved gaskets for dry-pipe service on all foam/water solution piping.

B. Grooved Fittings and Couplings: Grooved fittings, couplings and bolts shall be provided by the same manufacturer. Fittings and couplings shall be malleable iron or ductile iron complying with ASTM A 536. Couplings shall be of the rigid type except that flexible type will be provided where flexible joints are specifically required by NFPA 13. Coupling gaskets shall be Grade E (EPDM) approved for dry pipe fire protection service. Gasket shall be the flush type that fills the entire cavity between the coupling and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated. Gaskets must be compatible with foam concentrate and foam/water solution to which it will be exposed.

C. Non-Grooved Fittings: Non-grooved fittings shall be threaded or flanged. Do not use fittings that couple plain-end pipe or welded sprinkler fittings or outlets for foam-water solution. Threaded fittings shall be cast iron or malleable iron. Plain-end fittings with mechanical couplings, fittings which require drilling a hole in the pipe, and fittings which use steel gripping devices to bite into the pipe and welded sprinkler fittings or outlets are not allowed in the foam system and shall not be used.
D. Flanges and Gaskets: Flanges shall conform to NFPA 13. Flanges shall be the type that are welded or threaded to the pipe. Flanges which are bolted to grooved pipe will not be permitted. Gaskets shall be full face type EPDM or other approved material. Gaskets shall be compatible with foam concentrate and to foam/water solution to which it will be exposed.

E. Bolts: Bolts shall be ASTM A 449, Type 1 or 2. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

F. Nuts: Nuts shall be ASTM A 193/A 193M, Grade 5 ASTM A 563.

G. Washers: Washers shall meet the requirements of ASTM F 436M ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts.

H. Pipe Hangers: Hangers shall be listed by a Nationally Recognized Testing Laboratory (NRTL) and be of the type suitable for the application, construction and size pipe involved.

I. Control Valve: Unless otherwise indicated, valves shall be indicating type in accordance with NFPA 13. Valves 2-1/2 inch and larger shall be flanged outside screw and yoke (OS&Y) type. Gate valves shall open by counterclockwise rotation.

J. Check Valve: Check valves 4 inches and larger shall be flanged, swing type, cast or ductile iron body and cover, cast or ductile iron clapper with replaceable EPDM rubber facing. Valves shall be suitable for either vertical or horizontal mounting and equipped with a removable handhole cover. The direction of flow shall be indicated by an arrow cast in the valve body. The valve body shall include plugged pipe thread connections for a 2 inch drain.

K. Foam System Test Header: Provide a linear test header to meet the fire water demand of the foam/water system. Provide one 2-1/2 inch hose valve connection for each 375 gpm of flow, rounding up. Provide a control valve to isolate the test header from the remainder of the system. Locate test header inside the aircraft servicing area within 20 ft. of an exterior door or directly outside the fire protection equipment room on an exterior wall. Locate test header to discharge effluent to a hard surface within 100 ft. hose lay. In geographic locations having a 99.6% dry bulb temperature less than 32ºF (0ºC) per UFC 3-400-02 Engineering Weather Data, provide test header with automatic ball drip routed to the exterior.

L. Pressure and Vacuum Gauges: Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 3-1/2 inches in diameter with a range from 0 psig to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range. Gauge shall be liquid-filled type.

M. Surge Arrestors: At a minimum, provide the following surge arrestors. Increase the minimum capacities listed below, when manufacturer’s calculations are required and demonstrate a larger is required.

1. Provide 10 gallons of capacity for each dry-pipe or pre-action riser located on the riser manifold.
2. Provide 25 gal of capacity for each foam/water riser located on the riser manifold.
3. For each riser room, combine the surge capacity of the risers in the room into a single common surge arrestor. Connect this common surge arrestor to the riser manifold immediately upstream of the protected risers.

4. Where the fire pump is not located in the same room as the risers it serves, provide 100 gal capacity surge arrestors for each fire pump. Locate this surge arrestor immediately downstream of the fire pump discharge check valve.

5. The cumulative minimum capacity of each required fire pump surge arrestor may be combined into a single common surge arrestor. Connect this common surge arrestor to the fire pump header immediately downstream of the most remote fire pump.

6. Where surge arrestors are 100 gal or larger in capacity, provide floor stands.

7. Provide each arrestor with an indicating isolation valve to separate it from the system. Electrically supervise this valve in the normally open position. Provide a drain after the isolation valve to relieve pressure from the surge arrestor during testing and maintenance. When connecting the surge arrestor to the riser, the use of piping, fittings, and valving smaller than the connecting orifice on the surge arrestor is not permitted. After the surge arrestor is installed and pressurized in the field with nitrogen per the manufacturer’s written directions, provide a permanent label indicating the set pressure of the arrestor. Do not pressurize the surge arrestor during hydrostatic testing of the system.

2.7 FOAM CONCENTRATE PIPING AND FITTINGS

A. Pipe: Pipe shall be schedule 40 stainless steel. Pipe and fittings in contact with high expansion foam concentrate shall be material resistant to the corrosive effects of high expansion foam concentrate as approved by the manufacturer of the proportioning system.

B. Fittings: Foam concentrate fittings shall be stainless steel. Fittings must be of the same material as the pipe. Acceptable pipe joining methods are TIG welded, or gasketed welded flanges.

C. Pipe Hangers: Hangers shall be listed by NRTL and be of the type suitable for application, construction, and size pipe involved.

D. Control Valves: Valve shall be indicating type with full port ball and operating handle that indicates the on/off position of the valve. Unit shall be socket weld or flanged type. Valve body and ball shall be of 316 stainless steel complying with ASTM A 351/A 351M. The valve handle shall be provided with a suitable and substantial means for securing the valve open with a key-operated locking device.

2.8 STRAINER

A. Provide an isolation valve and wye or basket strainer in the piping ahead of foam system risers. Provide strainer baskets with stainless steel mesh sized no greater than 1/16 in (1.59 mm).

B. Welded steel body fire main basket-type pipeline strainer, UL listed for fire service. ASTM A53 pipe and class 150 steel flanges.

C. The strainer shall be designed to permit removal of the strainer screen for replacement and repair without removing the body from the line. A flush outlet shall be provided with each
strainer. Open screen area shall be at least 6 times greater than the nominal pipe size open area. Friction loss shall not exceed 1 PSI at design flow when tested with clean strainer screen and clean water.

2.9 FOAM/WATER FLOW CONTROL VALVES

A. Provide a flow control valve with remote resetting capability for each foam/water system. Provide flow control valve with automatic re-closing feature and adjustable speed control. Install the manual release for the flow control valve no higher than 5 ft. above finished floor. For hydraulic calculations, include the manufacturer’s minimum pressure drop across flow control valve for the features indicated.

B. Arrange valve for manual release at the valve. Provide pressure gages and other appurtenances at the flow control valves as required by NFPA 13. All trim piping must be brass with compatible fittings. Trim piping must be factory configured and installed. Gaskets must be made of EPDM. Valves must be operated by a control system listed for releasing service and independent of the building fire alarm system. Valves located in electrical classified locations must be listed for the classification of the area where located. Flow control valves must include the following features as standard elements of the valve and listed /approved trim package:

C. The electrical solenoid valve used to actuate the water control valve must be an integral component of the valve releasing control panel manufacturer. Solenoid valve must be of the normally closed, de-energized type, which opens when energized upon receipt of an electrical signal from the releasing control panel to which it is connected. Solenoid valves used with diaphragm-type valves must be rated for a maximum pressure differential of 175 psi. Electronic solenoids used for high expansion foam release must be listed for fire service applications and approved by the flow control valve manufacturer for use with the specific valve, and approved by the releasing panel manufacturer for use with the specific panel. Water control valve must be capable of recycling to the closed position at an adjustable speed.

D. Opening/closing speed control - Provide manufacturer's optional valve opening/closing speed control. Flow control valves must gradually open upon receipt of power from the foam system releasing panel and must slowly close upon interruption of power. Speed control setting must be adjusted such that valve closure occurs between 15 seconds and 30 seconds.

E. Flow control valve must be 8-inch Viking J-1 with trim package for electric releasing, remote re-setting, and opening/closing speed control (www.vikingcorp.com).

F. Where an inductor is used for foam/water proportioning, provided field adjustable pressure reducing trim.

G. Pressure regulation maintaining a constant pressure at the inductor and the discharge device (foam generator). Pressure deviation must not exceed ± 10 psig.

2.10 EMERGENCY FOAM/WATER SYSTEM SHUTDOWN
A. Provide sequential signage on the control valves for the emergency shutdown of the foam/water system. Locate these signs so they are readily visible near each valve used in the shutdown sequence. Provide signs with white background and a minimum 1/2 inch wide blue border with red lettering not less than 1 inch high. At a minimum, provide each sign with the language “EMERGENCY FOAM SHUTDOWN PROCEDURE” and the order and action to be performed (e.g. "1 - CLOSE FOAM CONCENTRATE VALVE", "2 - CLOSE FOAM/WATER RISER CONTROL VALVE"). Continue the sequence as required for shutdown.

2.11 HIGH EXPANSION FOAM LIQUID CONCENTRATE

A. Provide 2% high expansion foam concentrate listed by a Nationally Recognized Testing Laboratory (NRTL) for use with the foam generation system.

B. Concentrate must be the product of one manufacturer and must not contain PFOS/PFOA components. Concentrate must have a minimum 20-year shelf life. Manufacture date must be no more than six months before ship date to site. Mixing of non-identical specification concentrate will not be permitted.

C. Provide concentrate for primary tank based on the design as specified herein adequate to support 15 minute discharge at the hydraulically calculated water flow rate and 130% continuous system discharge.

2.12 CONCENTRATE STORAGE TANK

A. Provide a vertical, closed cell double wall polyethylene concentrate storage tank compatible with the required concentrate. Provide a reverse float level gauge with minimum 50 gallon increments permanently marked on the tank or gauge. Indicate on the tank or gauge the empty, full, and minimum level required to operate the system. Do not include the inaccessible portion of concentrate at the bottom of the tank that cannot be accessed by the suction line, in the tank's capacity markings. Provide a closeable fill opening and pressure/vacuum vent assembly.

B. Provide a concentrate storage tank with a supply of concentrate to support a 15 minute discharge at the hydraulically calculated water flow rate and 130% of the nominal concentrate injection rate.

C. Provide 1/4 inch layer of mineral oil on top of concentrate, after storage tank has been filled.

D. Enter the tank only through the top with no taps on the bottom or sides of the tank. Tank capacity must be 500 gallons or the volume required to fully submerge the inductor dip tube plus the design volume to operate the foam generators for not less than 15 minutes plus 60 gallons whichever is greater. There must be no taps in the bottom or sides of the tank. Inductor dip tube must enter through the top of the tank.

E. Tank Marking: Permanently label each tank with its capacity, concentrate manufacturer, and concentrate type and percentage of concentrate induction. The label must specifically identify the required concentrate manufacturer's name, concentrate name, concentrate identifying product numbers/codes, concentrate manufacturer's contact information including process to
obtain 24-hour concentrate re-supply. The label must include a warning statement indicating only this specific concentrate is permitted to be used in this system. Tank must have a NFPA 704 diamond sign indicating Health = 1; flammability = 2; and instability = 0.

F. Concentrate Fill Pump: Provide one pump system to fill the foam concentrate tank. Pump must be positive displacement having a flow rate between 7 gpm and 10 gpm. Pump must be complete with 120 VAC, 60 HZ motor, fused switch, power cord with US plug. Two clear hoses not less than 10 foot for suction and discharge.

2.13 FOAM/WATER PROPORTIONING SYSTEM

A. Foam proportioning must be by a single foam inductor for each foam-water riser. Inductor must be a model BFZ as provided by Fomtec® or USAF AFCEC approved equal.

1. Use a venturi to induct concentrate and proportion such concentrate into the flow stream reliably at the design system flow rate.
2. Tune the inductor specifically for the system required flow rate, inlet pressure, back pressure, concentrate type, proportioning ratio, and lift height of a near empty concentrate tank. Off the shelf pre-tuned generic model inductors are not permitted.
3. Design inductor to 115% of the nominal injection rate.
4. Size inductor for the exact orifice of foam/water pipe.
5. Fit concentrate suction line of the inductor with a low loss bronze or brass check valve assembly by the manufacturer that is included in the device's hydraulic design.
6. Provide a design that indicates the inductor's flow rate, inlet pressure, back pressure, and concentrate lift height for a near empty concentrate tank. Hydraulically calculate the back pressure for the inductor using the Hazen-Williams equation with a C-factor of a 100 for all piping downstream of the inductor.
7. Known manufacturers of such products include:
   a. Fomtec
   b. Skum
   c. Matre Maskin
   d. Wilson Foam
   e. Ansul, Chemguard
   f. Delta Fire

B. Foam Concentrate Piping: Provide a brass, bronze, or stainless steel full bore quarter turn ball valve with an electrically supervised tamper switch in the concentrate line. The use of automatically controlled valves in the concentrate line is prohibited. For testing purposes, equip the concentrate line with fittings and valving to accommodate the connection to an auxiliary tank of alternate test foam concentrate. Cap auxiliary tank connection at all times, except when testing. Provide a 3/4 inch copper line with ball valve from the fire water supply, that is used for flushing the concentrate line after use. Provide sign with the following instructions, "Flush concentrate line after discharge or testing. Close concentrate tank shut-off valve prior to opening this valve. After flushing, drain concentrate line through test connection prior to re-opening concentrate tank shut-off valve."
2.14 FOAM GENERATORS
   A. Generator shall be capable of producing not less than 14,490 cubic feet of expand foam-water solution per minute.
   B. Generator discharge characteristics shall not result in any foam solution being discharged on aircraft fuselage and wing components from direct impingement or misting. Generator operations pressure shall be such that high pressure fittings and system components must not be required.
   C. Total nozzle obstruction shall not negatively impact the distribution system hydraulics or foam induction capabilities.
   D. The foam generator shall be listed for use with the foam concentrate. The foam generator shall be powered by a water reaction motor. The water reaction motor shall provide both the screen wetting solution and the energy to drive the fan. The foam generator shall not require and outside power source, such as electricity. A stainless steel screen shall be provided for maximum reliability under fire conditions.
   E. A dedicated pressure gauge shall be installed at each foam generator for system testing, with readouts available at floor level. Pressure gauges and installation shall comply with testing portion of this specification.
   F. System must be designed to provide at each generator the manufacturer’s minimum operating pressure of plus 10 psi (plus-or-minus 5 psi).
   G. Generator nozzle hydraulics shall be compatible with simple inductor proportioning.

2.15 SURGE ARRESTER
   A. Equip every foam riser with a bladder type surge arrester sized by the manufacturer to prevent damage to the fire protection system. Minimum size is 10-gallon capacity. Units must be listed by an NRTL for fire service and have a working pressure of not less than 275 psi or design pressure whichever is greater. Provide pressure gauge for bladder/shell pressure reading. Provide wall-mount brackets for 10-gallon units. Provide sizing calculations performed by the manufacturer as a part of the submittal process.

2.16 FOAM RELEASING SYSTEM
   A. The Releasing Service Fire Alarm Control Unit (RSFACU) shall be an addressable listed for "Releasing Device Service" or shall have modules approved for this purpose. Panel shall contain components and equipment required to provide the specified operational and supervisory functions of the system. Components shall be housed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly factory assembled and wired unit. Panel shall include integral "power on," "alarm," and "trouble" lamps with annunciation of each alarm, supervisory and trouble signal. The panel shall have prominent rigid plastic or metal identification plates for zones, indicating lights.
controls, meters, and switches. Lamps and fuses mounted on circuit boards shall be identified by permanent markings on the circuit board. Nameplates for fuses shall also include ampere rating. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meter and lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. An integral graphical annunciator shall be provided to indicate and annunciate, by zone, any alarm, supervisory or trouble condition on the system, including the optical detection system, by use of LED and LCD indication. Upon restoration of power, start-up shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

B. Provide a separate FACU and RSFACU. Combining the FACU and RSFACU into a common control unit is not permitted.

C. Install the FACU and RSFACU in a location readily accessible to the emergency responders and maintenance personnel.

D. Provide a RSFACU for the control and release of the foam/water system. Design the system so the loss of a FACU or another RSFACU in the fire alarm system does not prohibit the RSFACU from functioning as intended (e.g., release or stop the foam/water system, alert the receiving station). Do not connect the RSFACU to other control unit through the use of a network cable. Communicate functionality between panels through addressable modules only. A common RSFACU may control multiple releasing systems or agents.

E. Connect and supervise only initiating and notification devices used by the foam/water system. Release the foam/water system only by the initiating devices. Additional devices are not permitted to release the foam/water system. (E.g. Do not release the foam/water system from the pressure switch on the foam/water riser.)

F. Locate the RSFACU, releasing modules, and monitor modules integral to the releasing and stopping of the foam/water system in a conditioned space with the following parameters: temperature between 60-80°F (15.6-26.7°C) and a relative humidity of 85% at 86°F (29.5 °C). Do not install these components in the hangar bay.

G. Where panels are located in normally occupied areas, provide recessed panels and combine miscellaneous components in common recessed enclosures to provide a clean installation. Where an auxiliary battery supply is required and cannot be recessed within the wall, locate it remotely in a normally unoccupied area.

H. Where panels, devices, and appliances are subjected to water spray/runoff under normal operating conditions, provide National Electrical Manufacturers Association (NEMA) 250 Type 4 enclosures and water tight conduit. Regardless of environmental conditions, do not provide openings or conduit entry into the top of the RSFACU.

I. RSFACU shall include, multi-spectrum infrared (IR) flame detectors, manual releasing stations, manual stop (abort) stations, signage panels, visual notification appliances, and miscellaneous appurtenances and circuit wiring in conduit, as required for a complete, operational, and fully functioning system. All components comprising the foam system alarm and control must be sourced through Det-Tronics, the manufacturer of the required RSFACU and optical flame
detectors, to ensure compatibility. For the purposes of this Contract, all Det-Tronics installation recommendations must be considered as mandatory requirements. All devices must be grounded in strict accordance with the Det-Tronics installation instructions. All circuit wiring must be installed as part of shielded cable assemblies, in rigid galvanized steel conduit, and grounded in strict conformance with the Det-Tronics installation instructions.

1. Releasing Service Fire Alarm Control Unit (RSFACU):

   a. RSFACU must be Det-Tronics Eagle Quantum Premier Fire Detection/Releasing System, must be equipped with redundant controllers and must be furnished complete with minimum 60-node Safety Systems Software (S3) configuration/logic programming/diagnostic tools software package including USB dongle key and RS232 cable. RSFACU alarm, supervisory, and trouble signal reporting to the Fire Alarm Control Panel must be via discrete dry contact output points. Modular type panel installed in a surface mounted NEMA Type 4 painted steel cabinet with hinged door and cylinder lock. Switches and other controls must not be accessible without the use of a key. The control panel must be a neat, compact, factory-wired assembly containing all parts and equipment required to provide specified operating and supervisory functions of the system. Panel cabinet must be finished on the inside and outside with factory-applied enamel finish. Provide main annunciator located on the exterior of the cabinet door or visible through the cabinet door.

   b. Provide audible trouble signal. Provide prominent engraved rigid plastic or metal identification plates, or silk-screened labels attached to the rear face of the panel viewing window, for all lamps and switches. System power must be 120 volts AC service, transformed through a two winding isolation transformer and rectified to 24 volts DC for operation of all system initiating, actuating, signal sounding, trouble signal and fire alarm tripping circuits. System must be electrically supervised on all circuits. A ground fault condition or a single break in any circuit which prevents the required operation of the system must result in the operation of the system trouble signal. Loss of AC power, a break in the standby battery power circuits, or abnormal AC power or low battery voltage must result in the operation of the system trouble signals. The abnormal position of any system switch in the control panel must result in the operation of the system trouble signals. Trouble signals must operate continuously until the system has been restored to normal at the control panel. System trouble must also be annunciated on the appropriate zone of the building fire alarm and mass notification control panel. The fire system control panel must control stations, abort stations, optical flame detectors, and all associated wiring must be connected to and supervised by the releasing system control panel. Control panel must be equipped with a NEMA Type 4 enclosure. System control panel must be UL listed or FM approved, for extinguishing system control (releasing device service). Permanently label all switches. Provide panel with the following switches:

   1) Trouble silencing switch which transfers audible trouble signals (including remote trouble devices, if provided) to an indicating lamp. Upon correction of the trouble condition, audible signals will again sound until the switch is returned to its normal position, or the trouble signal circuit must be
automatically restored to normal upon correction of the trouble condition. The silencing switch may be a momentary action, self-resetting type.

2) Alarm silencing switch which when activated will silence all associated alarm devices without resetting the panel, and cause operation of system trouble signals.

3) Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of the system and zone trouble signals.

4) Reset switch which when activated will restore the system to normal standby status after the cause of the alarm has been corrected, and all activated initiating devices reset.

5) Lamp test switch.

6) System release disable switch to disable the releasing functions of the panel while leaving all detection and other functions of the panel operational. Activation of this switch must transmit a non-latching supervisory alarm signal to the building fire alarm control panel. Switch must be provided within a lockable control panel.

J. Conduit Installation: Flexible conduit is only permitted when connecting to the following devices and appliances. Devices located on fire suppression equipment such as flow/pressure switches, solenoids, and tamper switches. Devices and appliances located in removable ceiling tiles, and where flexible conduit is specifically noted in this UFC (e.g. optical flame detectors). A maximum of two conduit penetrations are permitted into a secured area. Most areas only require one penetration. Provide self-amplified speakers or dedicated amplifiers within the secured area to meet the requirements.

1. Conduit and Enclosure Installation within the Hangar Bay: Provide NEMA 250 Type 4 wall mounted devices and appliances within the hangar bay (including backboxes). Provide watertight conduit and junction boxes throughout the hangar bay. Route conduit into the bottom of the backbox for manual foam releasing stations, stop stations, and flame detectors. Provide the low point of this conduit with a drain. Where the conduit is in a hazardously classified area, provide breathers in isolated portions of the conduit (e.g. sealed off from the remaining conduit system). Rate drains and breathers for the electrical (hazard) classification in which they are installed, but not be less than NEMA 250 Type 4.

K. Surge Protective Devices (SPD): Provide SPDs to protect all power supply circuits to the RSFACU, including any subpanels. Provide SPD to protect all circuits leaving or entering the building. Mount SPDs in a separate enclosure, unless the SPD is listed and installed in the control panel by the factory (e.g. Installing SPDs not listed with the panel is prohibited).

L. Main Annunciator: Provide integral with the main control panel. Supervision will not be required provided a fault in the annunciator circuits results only in loss of annunciation and will not affect the normal functional operation of the remainder of the system. Annunciator must have an alpha-numeric display and provide the description of the device.

M. System Zoning: The system shall be a single zone for foam discharge.
N. Primary Power Supply: Primary power and trouble alarm. Power to the control panel shall be as indicated. Panel shall be permanently marked “FOAM FIRE PROTECITON SYSTEM.”

O. Secondary Power Supply: Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

1. Batteries: Provide sealed, maintenance-free, sealed lead acid batteries as the source for emergency power to the RSFACU. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

   a. Capacity: Battery size shall be the greater of the following two capacities:

      1) Sufficient capacity to operate the fire alarm system under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal devices under alarm conditions for an additional 60 minutes.

      b. Battery Power Calculations: Verify that battery capacity exceeds supervisory and alarm power requirements.

         1) Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Include ampere-hour requirements for each system component and each panel component, and compliance with UL 864.

         2) Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Submit ampere-hour requirements for each system component with the calculations.

         3) A voltage drop calculation to indicate that sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries.

   c. For battery calculations use the following assumptions: Assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Amp-Hours for the specified standby time, and then calculate the required Amp-Hours for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period. Using this voltage perform a voltage drop calculation for circuit containing device and/or appliances remote from the power sources.

2. Battery Chargers: Provide a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 120 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (20.4 Volts dc), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours after a single discharge cycle as described in paragraph CAPACITY above. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.
P. RSFACU Supervised Disconnect: Provide a key operated RSFACU Supervised Disconnect switch to physically disable the solenoid for each foam/water and pre-action riser (if provided). Provide switch that disables the releasing functions without the use of programming, while leaving all other functions of the panel operational. Do not provide a trouble signal upon operation of the disconnect. Locate the disconnect switch in the riser room, in a readily accessible location near the solenoid. Provide a sign near the disconnect switch with a white background and a minimum 1/2 inch wide blue border, with “DISABLE FOAM SYSTEM” in red lettering not less than 1 inch high. Provide engraved labels on the disconnect switch indicating when the system is "ENABLED" or "DISABLED". Do not install backboxes or route conduit in front of sign in a manner that obstructs any lettering.

2.17 ALARM

A. Fire Alarm: Provide equipment and interconnections for the automatic transmittal of an alarm over the building fire alarm system as specified in Section 28 31 11 “Digital, Addressable Fire-Alarm and Mass Notification System.” Arrange so that actuation of any alarm initiating device (OFD or manual release station), trouble and supervisory conditions shall cause activation of the fire alarm and reporting systems.

B. Waterflow Pressure Alarm Switch: Unit shall include a 1/2 inch NPT male pipe thread, two 1/2 inch conduit knockouts, and two sets of SPDT (Form C) contacts. The switches shall be factory adjusted to transfer the contacts at 4 to 8 psi on rising pressure. Unit shall include a water-tight NEMA 4 die-cast aluminum housing with a tamper resistant cover which requires a special key for removal. The cover shall be provided with a tamper switch which shall operate upon removal of the cover. Units used on wet-pipe systems shall have an adjustable, instantly recycling pneumatic retard to prevent false alarms due to water pressure variation. Retard adjustment shall be factory set at approximately 20-40 seconds and adjustable between 0-90 seconds.

2.18 CONTROL VALVE SUPERVISORY (TAMPER) SWITCH

A. Electrically supervise normally open control valves.

B. Electrical or mechanical supervision is not required for normally closed control valves, unless opening the valve is detrimental to the system operation. When supervision is required on normally closed valves, provide electrical supervision (e.g. cable type monitoring).

C. Provide an addressable tamper switch for each fire protection system control valve. This includes, but is not limited to, providing tamper switches on all manual valves in the foam concentrate system and In-line Balanced Pressure Proportioning System. Tamper switches shall be UL listed as "Extinguishing System Attachment" for the location and type of valve supervised. The device shall contain double pole, double throw contacts. Operation of the switch shall cause a supervisory signal to be transmitted to the FACP upon not more than two complete turns of the valve wheel or a closure of 10 percent, whichever is less. Tamper switches shall be equipped with screw terminals for each conductor.
D. All valves which control alarm functions or the flow of water, foam, foam concentrate, or that when closed will disrupt the proper operation of a system shall be electronically supervised. This includes, but is not limited to, deluge valve alarm isolation valve, foam concentrate tank outlet line valve, foam concentrate tank water inlet valve, and water operated foam mixing valve pilot line valve.

2.19 TRIM VALVES
A. Mechanically lock or provide tamper seals (e.g. zip-ties) on trim valves, that when opened or closed are detrimental to the operation of the foam/water system (e.g. foam system pressure switch shutoff). Provide signage indicating the valve’s normal operating position.

2.20 DRAIN VALVES
A. Mechanically lock or provide tamper seals (e.g. zip-ties) on drain or trim valving in the closed position, that when opened will cause the discharge of the foam/water system (e.g. manual release valve on the foam/water system riser). Provide this valve with the following signage, “OPENING THIS VALVE WILL RELEASE THE FOAM SYSTEM.”

2.21 FOAM SYSTEM BEACONS AND PERFORMANCE BASED DESIGN
A. Provide blue visual alarm signals (rotating beacons) within the aircraft servicing area to indicate foam system activation. Mount signals 10 to 20 feet above the finished floor and located to be visible from all parts of the aircraft maintenance and servicing area. Beacons shall be circuited to Releasing Service Fire Alarm Control Unit (RSFACU) only. Provide performance based design per NFPA 72 for visible notification appliance in Maintenance Bay, as described in section 28 31 11.

B. Surface mounted industrial visual warning devices complying with UL 167. Devices must be a flashing rotary beacon (150 watt), strobe (300 candelas) or equivalent LED type and powered from the facility power and controlled by the foam system control panel. Flash rate shall be between 60 and 120 flashes per minute. Device must be blue.

2.22 MANUAL FOAM RELEASING STATIONS
A. Manual Foam Releasing Stations shall be as shown on the plans, and shall be weatherproof.

B. Provide distinctively different NEMA 250 Type 4 manual foam releasing stations and signage from the manual fire alarm pull stations. Provide tamper cover with colored portions in yellow and lettering on the cover reading “FOAM”; the words “FIRE”, “ALARM”, or “AGENT” are prohibited to appear on the cover. Provide locking type manual foam releasing stations that when activated require a key to be reset. Provide conventional manual foam releasing stations.
C. Protect foam releasing stations located in the hangar bay from mechanical. Provide a clear plastic tamper cover over the manual foam releasing station that when lifted emits an audible alarm.

2.23 MANUAL FOAM STOP STATIONS

A. Provide NEMA 250 Type 4 manual foam stop stations of the "dead-man" type at each manual foam releasing station. Use stop stations in conjunction with valves and equipment that stop the discharge of foam/water from the suppression system. Provide manual foam stop stations with distinctive signage at each device. Provide a red mushroom type push button and include the word “PUSH”. Provide the colored portions of the tamper cover in blue and lettering on the cover stating “STOP”; the words “FIRE”, “ALARM”, or “AGENT” are prohibited to appear on the cover or station. Do not locate addressable monitor modules for the manual foam stop stations in the hangar bay.

B. Once depressed, and so long as the button is held down, design the system so the stop station prevents/stops discharge of the foam/water system regardless of whether or not the foam/water system was activated automatically or manually, and whether or not the activation occurs prior to or after the stop station is pressed and held. Unless the RSFACU has been reset and all activation alarms (manual and automatic) have been cleared; restore the foam/water system operation when the foam stop station button is released. Do not exceed 15 seconds to fully close the flow control valve when the foam stop station button is depressed under full flow. Where the foam/water system is still in alarm, do not exceed 5 seconds to fully open the flow control valve upon release of the foam stop station button.

C. Protect manual foam stop stations located in the aircraft servicing area from mechanical damage. Provide a clear plastic tamper cover (without audible alarm) over the manual foam stop station.

2.24 MANUAL FOAM RELEASING AND STOP STATION SIGNAGE

A. Provide two separate but adjacent metal signs a minimum of 24 inches high by 20 inch wide. Provide no more than 12 inches of separation between the two signs. Do not use the words “FIRE”, “ALARM”, or “AGENT” on these signs. Do not install backboxes or route conduit in front of sign in a manner that obstructs any lettering.

B. Provide the sign for the manual foam releasing station with a yellow or lime-yellow background with “START FOAM SYSTEM” in red lettering not less than 3 inches high. Locate the manual foam releasing station with tamper cover on the lower portion of the sign. Provide the word “START” in minimum 1 inch high green lettering placed directly above the manual foam releasing station.

C. Provide the sign for the manual foam stop station with a white background and a minimum 1/2 inch wide blue border with “STOP FOAM SYSTEM” in blue lettering not less than 3 inches high. Locate the manual foam stop station with tamper cover on the lower left portion of the sign. Provide the word “STOP” in minimum 1 inch high red lettering placed directly above the manual foam stop station.
D. To the right of the stop button provide the following in minimum 1/2 inch high black lettering "To stop foam system, press and continuously hold STOP button until relieved by emergency responders. There may be up to a 30 second delay after pressing the STOP button before the foam stops."

2.25 OPTICAL FLAME DETECTORS

A. Optical Flame Detectors and Controller: Provide triple infrared (IR) optical flame detectors that are listed/approved for the expected fuel hazards in the hangar bay. Provide detectors that are immune to radar and radio frequency emissions from hand held equipment or equipment on-board the aircraft. Provide shielded circuiting from the optical detectors to the Releasing Service Fire Alarm Control Unit (RSFACU) and ground shielding at one end.

B. In order to reduce false foam activations from short circuits, ensure that components for in the hangar bay as follows: watertight back boxes, enclosures, and conduit/connections; and NEMA 4 junction boxes. All wiring serving the triple IR optical flame detectors shall be in conduit and enter the detector from the bottom. Provide shielding for the optical flame detectors and their circuits from radio frequency interference. Provide shielded circuiting from the optical detectors to the Releasing Service Fire Alarm Control Unit (RSFACU) and ground shielding at one end. Class X circuits per NFPA 72 shall be provided.

C. Optical flame detectors shall not alarm on non-fire sources, including but not limited to, arc welding, lightning, sunlight, radiant heaters, aircraft engine exhaust, hot surfaces, strobes, beacons, etc. Provide detectors that are immune to radar and radio frequency emissions.

D. The control panel will be directly connected to, and monitored by, the Releasing Service Fire Alarm Control Unit (RSFACU). The optical detection system shall be interfaced with the building fire alarm and reporting system, but shall not rely on it for operation. At least three separate dedicated zones shall be provided for reporting the status of the optical detection system to the remote location. One dedicated zone for the first optical detector in alarm, a second dedicated zone for the second optical detector in alarm, and a third dedicated zone for a fault signal in the optical detection system.

E. The system shall provide continuous and automated detection, while monitoring system operation through continuous supervision of its inputs/outputs. The detectors shall include continuous automatic periodic self-testing and calibration during operation, including lens cleanliness check, and IR sensor testing and automatic calibration. The detector shall have manual testing capability of the lens and sensors, that is easily performed and verified at the detector, without disassembly of the detector. Each detector shall have an integral indicator lamp, visible from the hangar floor, indicating whether it is in alarm (red), fault (amber), normal (green) status.

F. Optical Flame Detectors: Optical flame detectors must be Det-Tronics X3301 Series and no other, complete with laser holder and laser for aiming. Detector lens heating option must be set to zero.

PART 3 - EXECUTION
3.1 INSTALLATION

A. Aboveground Piping: Piping shall be installed straight and bear evenly on hangers and supports. Piping shall be concealed in areas with suspended ceiling and shall be inspected, tested and approved before being concealed.

1. Joints: Pipe joints shall conform to NFPA 13. Not more than four threads shall show after joint is made up. Joint compound shall be applied to male threads only. Joints shall be faced true, provided with gaskets and made square and tight. Flanged joints or mechanical groove couplings shall be provided where indicated or required by NFPA 13. Pipe grooves shall be made by the cut-groove method. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published installation instructions. All grooved couplings and fittings shall be from the same manufacturer. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

2. Fittings: Use flanged or welded fittings to transition the fire protection water service entrance from horizontal to vertical as it enters the building. Do not use gasketed compression fittings (including locking type) or flanged fittings with set screws.

3.Reducers: Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

4. Valves: Provide a butterfly valve beneath each flow control valve in each riser, when more than one valve is supplied from the same water supply pipe.

5. Pipe Supports and Hangers: Installation methods outlined in NFPA 13 are mandatory. Protection of piping and all foam equipment including foam tanks and generators against damage from earthquakes shall be provided. Longitudinal and lateral sway bracing shall be provided for piping.

6. Foam/Water Solution Piping Seismic Bracing: Seismically brace foam/water solution piping regardless of geographic location. Base bracing calculations on an Ss of 0.95 or as indicated in the seismic analysis, whichever is greater.

7. Pipe Penetrations: Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted.

a. Escutcheon Plates: Escutcheons shall be provided at finished surfaces where exposed piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe and shall be chromium-plated iron or chromium-plated brass, either one-piece or split-pattern, held in place by internal spring tension or setscrew.

b. Pipe Sleeves: Refer to Section 210517 “Sleeves and Sleeve Seals for Fire-Suppression Piping.” Pipes penetrating concrete or masonry walls or concrete floors shall be provided with pipe sleeves fitted into place at the time of construction through its respective wall or floor, and shall be cut flush with each surface. Sleeve sizes and clearance between pipe and sleeve shall be in accordance with NFPA 13. Provide not less than 1/4 inch space between exterior of piping and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic waterproof cement. ASTM A53/A53M, schedule 40 or
standard weight, zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 3 inches above the finished floor. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07 84 00 “Firestopping.”

c. Sleeves in Partitions: Provide zinc-coated steel sheet having a nominal weight of not less than 0.90 pounds per square foot.

d. Drains: Main drain piping shall be provided to discharge at safe points outside each building. Drains shall be of adequate size to readily receive the full flow from each drain under maximum pressure. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line. Each drain valve shall be provided with a metal sign identifying the type of drain connection or function of the valve.

e. Identification Signs: Refer to Section 210553 “Identification for Fire-Suppression Piping and Equipment.” Signs shall be in accordance with NFPA 13. Properly lettered and approved metal signs shall be suitably affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate. See drawings for additional sign requirements. Identification signs shall indicate Normally Open or Normally Closed as appropriate.

3.2 ELECTRICAL WORK

A. Except as modified herein, electric equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 283111 Digital, Addressable Fire-alarm and Mass Notification System. All wiring for supervisory and alarm circuits shall be minimum #16 AWG solid copper installed in metallic tubing or conduit. Wiring color code shall remain uniform throughout the system.

B. System Field Wiring: Provide control wiring and connections to fire alarm systems, under this section and conforming to NFPA 70 and NFPA 72. All wiring must be color coded. Wiring, conduit and devices exposed to water or foam discharge must be NEMA 4. Wiring, conduit and devices located in hazardous atmospheres, as defined by NFPA 70 and as shown, must be NEMA 7 (explosion proof). All conduit must be minimum 3/4 inch size.

C. Wiring Within Cabinets, Enclosures, Boxes, Junction Boxes, and Fittings” Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors which are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box must be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved pressure type terminal blocks, which are securely mounted. The use of wire nuts or similar devices must be prohibited.

D. Terminal Cabinets: Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size must be appropriate for the size of the wiring to be connected. Conductor terminations must be labeled and a drawing
containing conductors, their labels, their circuits, and their interconnection must be permanently mounted in the terminal cabinet. Minimum size is 8 inches high by 8 inches.

E. Alarm Wiring: Signaling line circuits and initiating device circuits must be Class B field wiring must be copper, No. 18 AWG size conductors at a minimum. Notification appliance circuit conductors, that contain audible alarm devices, must be solid copper No. 14 AWG size conductors at a minimum. Wire size must be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC must not operate at less than 21.6 volts. Circuits operating at any other voltage must not have a voltage drop exceeding 10 percent of nominal voltage. Power wiring, operating at 120 VAC minimum, must be No. 12 AWG solid copper having similar insulation. Provide all wiring in rigid metal conduit or intermediate metal conduit minimum ¾". Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 5 foot length must be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring must be utilized where recommended by the manufacturer. For shielded wiring, the shield must be grounded at only one point, which must be in or adjacent to the RSFACU. All wiring must be installed splice free. Pull a dedicated earth ground conductor on all runs and bond to enclosures, boxes, and field devices which have ground terminals. Color coding is required for circuits and must be maintained throughout the circuit.

F. Conductor Terminations: Labeling of conductors at terminal blocks in terminal cabinets, RSFACU, and remote foam system control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, RSFACU, and foam system control unit shall contain a laminated drawing which indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

G. Operating Power: Power shall be 120 volts AC service, transformed through a two winding isolation type transformer and rectified to 24 volts DC for operation of all signal initiating, signal sounding, trouble signal, and actuating (releasing) circuits. Provide secondary DC power supply for operation of system in the event of failure of the AC supply. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and shall not cause transmission of a false alarm. Obtain AC operating power for control panel, and battery charger as indicated on the drawings.

H. Conductor Identification: Identify circuit conductors within each enclosure where a tap, splice or termination is made. Identify conductors by plastic coated self-sticking printed markers or by heat-shrink type sleeves. Attach the markers in a manner that will not permit accidental detachment. Properly identify control circuit terminations.

I. All conduit shall be factory painted red in unfinished areas. In finished areas, conduit may be painted to match room finish and with red painted ¾-inch wide bands every 20 feet and on both sides of walls. Comply with UFC 3-600-01.
3.3 FOAM GENERATOR INSTALLATION

A. Install Hi-Ex foam generators to provide a minimum 20 inches clearance in front of the generator inlet. Seismically brace generators regardless of geographic location. Base bracing calculations on an Ss of 0.95 or as indicated in the seismic analysis, whichever is greater. The use of all-thread rod for supporting generators is not permitted.

B. Tap the generator foam/water supply piping with a valve to allow for the attachment of a pressure gauge or sampling hose during testing.

C. Locate Hi-Ex generators to discharge within close proximity, but not directly upon the aircraft. When mounting generators in the horizontal position, take into account the throw pattern of the Hi-Ex foam discharge. Do not locate the generator where the Hi-Ex foam discharge is obstructed (e.g. structural members) or in areas that obstruct service equipment (e.g. crane travel path). Use the initial discharge from the foam generators to protect under the aircraft fuselage and underwing area, prior to spreading to the remaining hangar bay floor area.

D. Do not provide generators in locations where the developing foam blanket will block exits from the hangar bay within the first minute of discharge. Blocked exits are defined as an exit that is obstructed by a foam blanket exceeding 5 ft. in depth.

3.4 INDUCTOR INSTALLATION

A. Provide a single foam inductor per foam/water riser meeting the requirements outlined below. Where more than one foam inductor is used, they may take suction from a common concentrate tank. Do not supply more than one fire area from a single inductor.

B. Install inductor in the horizontal piping over the top of the concentrate tank. Provide the minimum straight pipe on both sides of the inductor in accordance with the manufacturer. Install these sections of piping free of elbows, tees, and reducers. Provide liquid filled gauges, located no closer than 2 ft. before and after the inductor.

C. The inductor must be elevated above the maximum fill level of the concentrate tank and have no automatic control valves in the concentrate line. Inductors must be installed with not less than 48 inches straight pipe up and down stream of the inductor. Provide gauge cocks with oil-filled gauges (0-200 psi, 2.5 percent accuracy) 3 feet before and after the inductor. Provide permanent engraved rigid plastic or corrosion-resistant metal constructed label for each control device.

3.5 MANUAL RELEASE STATIONS INSTALLATION

A. Provide low-level high expansion foam manual release stations where shown. Stations shall be of a type not subject to operation by jarring or vibration. Stations shall be of all metal construction and have a dual action release configuration to prevent accidental system discharge. Break-glass-front stations are not permitted. Station shall provide positive visible indication of operation. Restoration shall require use of a key. Place warning signs at each station indicating that operation of the station will cause immediate high expansion foam
discharge. Where a building fire alarm manual pull station is also mounted in the vicinity of a foam manual release station, separate the stations by at least 5 feet horizontally. Mount station on signage panel as specified herein and detailed on drawings. Manual releasing stations shall be locking type that, when activated, require a key to be reset. Manual releasing stations shall be surface mount. Manual releasing stations shall be yellow in color, distinctly different from manual fire alarm stations, and shall be mounted on a signage panel. Manual releasing stations shall have the word "FOAM" on the front exterior of the enclosure. No other words shall appear anywhere on the exterior of manual releasing station enclosures. Manual releasing stations shall be equipped with clear plastic tamper covers. The tamper covers shall have the word "FOAM" on the front. No other words shall appear anywhere on the exterior of tamper covers. Stations including associated surface mount back boxes shall be weatherproof type with bottom conduit entry only. Stations with top conduit entry hubs are not acceptable.

B. Where a manual foam releasing station is installed near an exit or exit access, install it on the opposite side of the door from the general fire alarm pull station, if provided.

3.6 OPTICAL FLAME DETECTOR INSTALLATION

A. Provide a sufficient number of optical flame detectors around the perimeter of the hangar bay, such that all portions of the hangar bay are within the range and cone-of-vision of at least three detectors. Exception: The area of the hangar bay within 5 ft. of the perimeter wall is not required to be within the cone-of-vision of an optical flame detector. No aircraft silhouette will be solely visible from optical flame detectors located on one side of the fuselage. Where the single aircraft wing area exceeds 1,000 sf, a minimum of two optical flame detectors covering the aircraft silhouette are required on each side of the fuselage.

B. Angle detectors and provide blinds (field of view inhibitors) so the cone-of-vision is contained within its designated suppression zone and does not extend more than 5 ft. outside the hangar bay, into another fire area (e.g. through normally open roll-up fire doors), or is within the view of hot sources such as radiant heaters. Locate optical flame detectors at a sufficient distance per the manufacturer's recommendations from sources that may cause false alarms (e.g. welding, solar glare, radiant heaters, aircraft engine exhaust, strobes, hot surfaces and other relevant sources.)

C. Mount detectors in accordance with their listing at approximately 8 ft. above the finished floor of the hangar bay. Do not mount optical detectors in inaccessible locations. Provide optical flame detectors with 5 ft. of flexible conduit to allow for minor adjustments during testing or changes in the mission of the hangar bay.

D. Permanently mark on each detector the horizontal and vertical axis determined during testing. Provide optical flame detectors with 5 feet of flexible conduit to allow for minor adjustments during testing or changes in the mission of the hangar bay.

E. Calibrate optical flame detectors to operate upon viewing the flame signature of the expected fuel(s) to be in the hangar bay. Use a 2 ft. x 2 ft. pool fire as the bases to set the sensitivity of the optical flame detectors. Upon the 2 ft. x 2 ft. pool fire reaching full development, all detectors within the cone-of-vision are required to activate within 30 seconds.
F. The representative from the manufacturer of the optical flame detection system shall perform all programming on, and witness and certify acceptance testing (including witnessing pan fire tests on site), on the triple IR detection system. The manufacturer's representative, who programs, and certifies and witness the acceptance tests, shall submit qualifications to the government for approval.

3.7 PIPE PAINTING AND LABELING

A. Painting: Paint all exposed interior piping (color will be the same as the walls and or ceiling, or a complementing color). Do not paint exposed interior fire protection piping red. Exposed piping in the fire protection equipment room and mechanical rooms may be left unpainted. Stainless steel piping may be cleaned and left unpainted.

B. Clean, prime, and paint new foam systems including valves, piping, conduit, hangers, miscellaneous metal work, and accessories. Apply coatings to clean dry surfaces using clean brushes. Clean the surfaces in accordance with SSPC SP 11. Immediately after cleaning, prime the metal surfaces with one coat of SSPC Paint 25 or SSPC Paint 25 primer applied to a minimum dry film thickness of 1.5 mils. Exercise care to avoid the painting of sprinkler heads and operating devices. Upon completion of painting, remove materials which were used to protect sprinkler heads and operating devices while painting is in process. Remove sprinkler heads and operating devices which have been inadvertently painted and provide new clean sprinkler heads and operating devices of the proper type. Finish primed surfaces as follows:

1. Foam Systems in Unfinished Areas: Unfinished areas are defined as attic spaces, spaces above suspended ceilings, crawl spaces, foam rooms, pump rooms, pipe chases, and other spaces where ceilings are not painted or not constructed of a prefinished material. Paint primed surfaces with two coats of CID A-A-2962 red enamel applied to a minimum dry film thickness of 1.5 mils.

2. Foam Systems in All Other Areas: Paint primed surfaces with two coats of paint to match adjacent surfaces, except paint valves and operating accessories with two coats of CID A-A-2962 red enamel applied to a minimum dry film thickness of 1.5 mils. Provide piping with 2 inch wide red bands spaced at maximum 20 foot intervals throughout the piping systems. Bands shall be red enamel or self-adhering red plastic tape.

C. Mark all exposed interior piping with plastic wrap around-type pipe labels conforming to American Society of Mechanical Engineers/American National Standards Institute (ASME/ANSI) A13.1-1996, Scheme for the Identification of Piping Systems. Indicate the type of fluid carried and direction of flow. Labels that stick-on (adhesive backed) or are held on with straps/adhesive tape are not permitted. Labels are not required on any fire suppression system branchlines regardless of size, or mains and cross-mains less than a nominal 2-1/2 in. Labels are not required on piping routed below the floor line in trenches or pits. Refer to Section 210553 “Identification for Fire-Suppression Piping and Equipment.” At a minimum, the following labels are required:

1. FIRE PROTECTION WATER - Used on dedicated potable and non-potable fire protection water supply piping.

2. FOAM CONCENTRATE - Used on foam concentrate piping.
3.8 INSPECTION BY FIRE PROTECTION SPECIALIST

A. The Fire Protection Specialist shall inspect the system periodically during the installation to assure the system is being provided and installed in accordance with the contract requirements and the approved sprinkler system submittal(s). This Fire Protection Specialist shall attend all the preliminary and final tests, and shall sign the test results. After the preliminary testing has been completed, the Qualified Fire Protection Engineer shall certify in writing that the system is ready for the final inspections and tests. This report shall document any discrepancies found and what actions will be taken to correct. Any discrepancy noted during the periodic site visits or the preliminary testing shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.9 FORMAL INSPECTION AND TESTING REQUESTS

A. Submit the request for formal inspection and testing at least 30 working days prior to the date the inspection is to take place.

1. All Certification that preliminary testing has been completed and a copy of the preliminary test report shall accompany the request for formal inspection.
2. The control panel(s) and detection system(s) shall be in continuous service for a "break-in" period of at least 15 consecutive days prior to the formal inspection.
3. Experienced technicians regularly employed by the Contractor in the installation of both the mechanical and electrical portions of such systems shall be present during the inspection and shall conduct the testing.
4. All HIGH EXPANSION FOAM concentrate, instruments, including optical flame detector test lamp and function test kit, personnel, appliances and equipment for testing shall be furnished by the Contractor. All necessary tests encompassing all aspects of system operation shall be made including the following, and any deficiency found shall be corrected and the system retested at no cost to the Government.
5. The Contractor shall submit the Final Acceptance Test.
6. Provide protection for all electrical fixtures and equipment exposed to possible damage during tests and protect doors and other openings leading from the protected area(s), to prevent migration of foam solution into other areas or spaces. Install plastic sheeting over all wall and door surfaces from the finish floor to not less than 20 feet above the finish floor.

3.10 TESTING PERSONNEL

A. The Qualified Fire Protection Engineer shall witness and/or review of testing/reports as outlined in this section.

B. At a minimum, provide a factory authorized representative for the startup and/or testing of the following systems as outlined below:
1. Fire Suppression System (Preliminary and Final Testing)
2. Foam Proportioning System (Preliminary and Final Testing)
3. Fire Pump System, When Provided (Start Up)
4. Fire Alarm and Mass Notification System (FACU/ACU) (Preliminary and Final Testing)
5. Foam/Water Releasing System (RSFACU) (Preliminary and Final Testing)
6. Optical Flame Detection System (Preliminary and Final Testing)

3.11 FOAM/WATER DISCHARGE TESTING PLAN

A. Contractor must prepare a plan for conducting the test and the duties of the test team. Contractor must remove any mobile / portable equipment from the hangar servicing area. Contractor must cover the hangar walls and surface mounted equipment with plastic sheeting from the finished floor to 20 feet above the finished floor. Doors into adjacent areas must be protected to prevent foam-water solution leaking into the adjacent areas during the test and subsequent clean-up. The test and any re-test will begin with the system in normal configuration; no recharging of the system piping is allowed. Hangar doors will be closed and will remain closed until the hangar is released to the contractor's clean-up team.

B. Provide a testing plan certified by the QFPE that includes the following:

1. Who will perform the testing and who will be the onsite factory authorized representatives.
2. What are the safety precautions taken during testing.
3. How will the foam/water system be tested to demonstrate the performance criteria has been met.
4. How will the event be recorded for future review.
5. What are the testing procedures to demonstrate the coordination and communication of the fire protection systems associated with the foam/water discharge.
6. How will the hangar bay be protected during the discharge of foam.
7. How will the foam be captured during the discharge and disposed.

3.12 PRELIMINARY TESTING REPORTS

A. Provide acceptance testing for the fire suppression and fire alarm systems. At a minimum, provide the following preliminary testing reports.

2. Contractor's Material and Test Certificate for Aboveground Piping per NFPA 13 for each riser, manifold, and fire department connection. (Reviewed by the QFPE)
3. Fire pump test report demonstrating compliance with NFPA 20 acceptance testing criteria. Where a concentrate pumping system is also provided, demonstrate compliance with NFPA 11 and 20 acceptance testing criteria. (Reviewed by the QFPE)
4. Provide the residual pressure at the most remote generator with the simultaneous operation of the foam/water system, overhead hangar bay sprinkler system simulation, and exterior hose demand (when applicable). Simulate the overhead sprinkler system and hose demand through the test header. Provide pitot measurements and type of equipment used for this simulation. Provide the inlet and outlet pressures of the flow control valve. A water only test is acceptable. Use this information to verify the hydraulic performance of the system. (Reviewed by the QFPE)

5. Provide a proportioning system test report demonstrating compliance in accordance with NFPA 11. (Reviewed by the QFPE)

6. System record of Inspection and Testing, Notification appliance supplementary Record of Inspection and Testing, Initiating Device Supplementary Record of Inspection and Testing, Interface Component Supplementary Record of Inspection and Testing, and Mass Notification System Supplementary Record of Inspection and Testing per NFPA 72 for the FACU and RSFACU. (Reviewed by the QFPE)

3.13 FLUSHING

A. Underground water mains shall be flushed in accordance with NFPA 13 and NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the maximum water demand rate of the system.

3.14 HYDROSTATIC TESTS

A. The aboveground piping systems, including foam concentrate, shall be hydrostatically tested in accordance with NFPA 13 at not less than 225 psi, or 50 psi in excess of maximum system operating pressure, for 2 hours. There shall be no visible leakage from the piping when the system is subjected to the hydrostatic test.

3.15 HIGH EXPANSION FOAM CONCENTRATE SYSTEM

A. The contractor shall provide high expansion foam concentrate for all testing (initial and acceptance) and any required retesting. Concentrate tanks shall be full (not less than that shown in the contract, or not less than the minimum quantity intended to provide the 15 minute operating time, whichever is greater) for all tests. Foam concentrate removed from the tank for repairs or adjustments shall not be reused unless the concentrate manufacturer certifies the removed concentrate is of the same quality as original new concentrate. Following approval of all testing by the Contracting Officer and completion of all "punch list items" the contractor shall replenish the concentrate storage tank with not less than the minimum design quantity shown on the contract, or at least enough to provide 15 minutes of operating time, whichever is greater.

B. Tests shall be conducted under the supervision of a technical representative employed by the foam concentrate manufacturer. The complete foam concentrate system shall be adjusted and tested to assure proper operation. Test results, including all pressure settings and readings, shall be recorded on an appropriate test form signed and dated by manufacturer's representative
certifying that the system is in compliance with contract requirements and the manufacturer's recommended practices. Testing shall include, but not be limited to, the following:

1. Filling the foam concentrate tank.
2. Adjustment of proportioners.
3. Collection of foam samples and testing with a conductivity meter to verify proportioning accuracy.
4. Other operational checks recommended by the Hi-Ex proportioner manufacturer.
5. Readings of high expansion foam in tanks before and after testing shall be taken, along with test time, to determine adequacy of tank for 15 minute supply.

C. Inductor Tests: The inductor shall be flow tested to determine that proportioning accuracy is within specified limits. The inductor shall be tested at the design flow rate with the overhead sprinkler flow being simulated using the test header. Foam samples from inductor shall be accomplished in accordance with NFPA 11 and the approved test plan. Foam solution concentrations shall be determined using a refractometer or conductivity measurements and the methods outlined in NFPA 11.

3.16 BREAK-IN PERIOD FOR FACU AND RSFACU

A. Provide a break-in period of at least 14 consecutive days after the FACU and RSFACU have been enabled, prior to any formal testing. Provide a written request for a final test from the QFPE, after preliminary testing is complete, adjustments have been made to the system, and the system is ready for service.

3.17 FIRE ALARM/MNS AND RELEASTING SYSTEMS FUNCTIONAL PRELIMINARY ACCEPTANCE TESTING (PAT) AND FINAL ACCEPTANCE TESTING (FAT)

A. Every feature and function of the FACU and RSFACU, including initiating, alarm, and actuation systems shall be operated.

B. The contractor and foam system manufacturer's representatives shall conduct these tests under the direction of the fire department. The PAT and FAT shall be witnessed by the Contracting Officer's Representative, the fire department, AHJ, and the fire protection specialist. Additionally, after successful PAT, the AHJ, QFPE, and fire protection designer of record, shall witness and approve the FAT.

C. As a minimum, operation and supervision of the following functions and devices shall be demonstrated:

1. All operational and supervisory functions of the control and annunciator panels.
2. Each foam system manual start and manual stop stations and associated circuit(s) without foam discharge. For this test, the actuating solenoid shall be removed from the foam system control valve, and a bolt placed in it to indicate when it receives power.
3. All optical flame detectors and associated circuits.
4. Each general alarm initiating device (manual pull stations, flow switches, pressure switches, and associated circuit(s)).
5. Each supervisory initiating device or function (valve tamper switch, tank level supervisory panels, fire pump controllers, etc) and associated circuit(s).
6. All alarms and associated circuits.
7. All actuator circuits and system control valve(s) (without foam discharge).
8. Activation of the building fire evacuation alarm system.
9. Activation of the installation fire alarm reporting system (receipt of fire alarm, trouble, supervisory signals at receiving station).
10. All of the above tests shall then be repeated with the system on battery power only.
11. Annunciator lamp and notification appliance. This shall include bells, horns, electronic signaling, and similar devices.
12. Test of each function of the control panel.
13. Test of each circuit in both trouble and normal modes.
14. Tests of the battery charger and batteries.
15. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
17. Ground fault.

3.18 FLOW CONTROL VALVE (FCV) FUNCTIONAL TESTING

A. Flow control valve (FCV) functional testing. Operate flow control valves and adjust valve open/closure speed and discharge pressure settings as specified. Demonstrate proper pressure settings and valve operation speed by utilizing the nozzle test/drain assembly at the most remote nozzle to record system pressure and by using the system abort station to stop and restart flow. Seal the pressure regulator, opening speed, and closure speed valves in their final "set" position with safety wire in the same manner as aviation mechanics seal critical fasteners on power plants. Wire seals shall prohibit casual movement of valves. Permanently record the final FCV discharge pressure setting on each valve.

3.19 FINAL TESTING

A. Final testing to be witnessed by the Authority Having Jurisdiction (AHJ). The final testing may be witnessed by a delegated representative at the discretion of the AHJ. With the exception of system flushing and hydrostatic testing, repeat preliminary tests during the final testing at the discretion of the AHJ. Correct system failures or other deficiencies identified during the final testing and retest in the presence of the AHJ, at their discretion.

3.20 PRELIMINARY ACCEPTANCE TESTING (PAT) AND FINAL ACCEPTANCE TESTING (FAT) FOR THE OPTICAL FLAME DETECTION SYSTEM

A. Contractor and optical flame detector manufacturer's representative shall conduct these test under the direction of USACE and the fire department. The PAT and FAT shall be witnessed by the Contracting Officer's Representative, the fire department, AHJ, and the fire protection
specialist. Additionally, after successful PAT, the AHJ, QFPE, and fire protection designer of record, shall witness and approve the FAT.

B. Corrections shall be made to triple IR detectors or controls not responding and tests repeated as necessary. If the sensitivity of a detector(s) needs to be changed to pass a test, all other tests, and certifications/qualifications for immunity against false alarms, performed up to that time need to be repeated. The Contractor shall protect the building and installed equipment from possible smoke and/or fire damage.

C. The contractor shall post suitable signs the day prior to and during testing indicating the date and time fire detection, alarm and suppression testing is to occur.

D. The Contractor shall engage the services of the optical flame detector manufacturer to conduct the actual pan fire tests.

E. The Contractor shall provide a liquid tight high welded steel fire pan with detached removable steel cover, and steel sub-frame with rollers/casters to allow for convenient relocation of the fire pan, or equivalent. The Contractor shall obtain JP-8/JET-A/JET/A1 fuel from the Government for use in the fire pan, and shall conduct pan fire tests to demonstrate the performance of the optical flame detectors.

F. Detector pass/fail status shall be determined by comparison of detector performance during pan fire tests relative to the detector manufacturer's published performance data for the specific type detector being tested.

G. Pan fire tests shall be conducted in up to 12 separate locations to be determined by the Government. No foam shall be discharged during pan fire tests. Coordinate with the Contractor Officer prior to conducting any pan fire tests.

H. Demonstrate the performance requirements of the optical flame detector coverage has been met through pan fire acceptance testing. Use the expected fuel in a 2 ft. x 2 ft. test pan, with closable lid.

I. The use of a cleaner burning fuel and/or alternate test pan design may be used where acceptable to the Authority Having Jurisdiction (AHJ).

J. At a minimum, place the test fire in each designated aircraft parking position (minimum of three). To pass, all detectors within the cone-of-vision of this test fire must activate within 30 seconds of fuel ignition. The fuel oil in the fire pan shall be pre-heated to its flash point temperature prior to each test, for a rapid full fire development in the pan.

K. Centered the test fire 10 ft. (3.0 m) outside the hangar bay opening. To pass, no detectors should active after 30 seconds of full fire development.

L. During testing, all suppression systems shall be disconnected. The foam system shall be deactivated prior to beginning testing, to prevent accidental discharge.

M. In addition to the pan fire test, the following tests shall be performed in the hangar bay:
1. At each aircraft parking location, and one additional location determined by the COR, perform arc welding of plate steel inside the hangar bay, at 125 amps for five minutes, and confirm that the detectors do not activate.

2. Perform welding activities on the facility for a maximum of five minutes, at one location determined by the COR, and confirm there is no feedback through the building ground to the triple IR detection system.

3. Activate existing strobes and rotating beacons inside the hangar, and confirm that optical detectors do not activate the system.

4. Ensure that the following outputs from the triple IR controller are received by the releasing panel, fire alarm control panel, and fire reporting receiving station: triple IR first alarm, triple IR second alarm, and triple IR fault. Confirm that the triple IR bypass switch disables the triple IR system.

N. The contractor shall provide written documentation of tests and state that the system is fully functional in accordance with all criteria.

O. The contractor shall properly dispose of fire testing materials.

3.21 PRELIMINARY ACCEPTANCE TEST (PAT) AND FINAL ACCEPTANCE TEST (FAT) CHECKLIST FOR THE HIGH EXPANSION FOAM SYSTEM

A. The contractor shall have provided written documentation of a successful optical flame detector system PAT before scheduling the High Expansion Foam System PAT and state that the Optical Flame Detection System is fully functional in accordance with all criteria. All optical testing has been performed to specification.

B. When all of the initiating, alarm, actuation, and supervisory functions of the system operate to the satisfaction of the system manufacturer's technical representative and the AHJ; the contractor must conduct a full complete discharge test of the each system servicing each separated fire area. The test must be performed to demonstrate satisfactory performance, proper HIGH EXPANSION FOAM concentration, mechanical operation and operation of valves, release devices, alarms, and interlocks which control the protected areas. These tests shall be conducted by experienced personnel according to the equipment and HIGH EXPANSION FOAM manufacturers' recommendations.

1. Develop a check list prior to commencing preliminary and final acceptance tests which includes the following:
2. The intent is to stream line the preliminary and final acceptance testing procedures and to accomplish a successful and quality acceptance test.
3. This check list is used in assigning action items to the subcontractors by the CQC manager.
4. During the discharge test, no one is permitted on the floor of aircraft service area. Persons witnessing the test will be required to view from an elevated position that does not require them to exit the building through the foam. Ensure that there is adequate egress off the elevated position which complies with the Life Safety Code (NFPA 101). The foam blanket will reach a level above the average person's height causing spatial and acoustic disorientation possibly resulting in injury.
5. Provide a safety plan for conducting test of High Expansion Foam System (Hi-Ex). Provide a sketch of safe egress path for persons conducting and witnessing the test to exit the building without entering the foam blanket. Obtain approval from the Base Safety Manager.

6. Environmental Permits:
   a. Obtain local, state or US environmental permits as applicable.
   b. Obtain approval from Base Environmental Engineer or Base Civil Engineer.
   c. Provide Hi-Ex Foam Containment Plan and Procedures.
   d. Provide Hi-Ex Foam Disposal Plan and Procedures.

7. Provide procedures for taking protective measures to avoid damage to life and property during and after the test.

8. Discuss the testing procedure with the fire department and obtain approval.

9. Provide test procedures for each specification section separately.

10. Provide a list of tests to be performed for each specification section.

11. Provide a test plan for each day of the test such as Day 1, Day 2, etc.

12. Allocate adequate time for each test. One hundred percent testing will be done during PAT and FAT. Simultaneously conducting more than one test is not permitted. Do not mix training with testing. The contractor and foam system manufacturer's representatives shall conduct these tests under the direction of the AHJ and the fire department. The PAT and FAT shall be witnessed by the Contracting Officer's Representative, the fire department, and the fire protection specialist. Additionally, after successful PAT, the AHJ, QFPE, and fire protection designer of record, shall witness and approve the FAT.

13. Ensure that CQC fire protection engineer is present at for PAT and FAT.

14. Ensure that manufacturer's representatives are present and have adequate time.

15. Provide a procedure for each test per attached testing procedure form format.

16. Provide blank test data recording form for each test. The attendee-sign-up sheet if needed shall be separate from test data recording form. Use NFPA forms when available.

17. Provide calibration certificates for each instrument used for testing. The testing equipment must be calibrated within previous 12 months from the date of testing. The flow tests are invalid without calibration certificates.

18. Obtain and Provide test procedures (from the equipment manufacturer and NFPA) for the following equipment:
   a. Foam System.
   b. Foam proportioner test IAW NFPA 11.
   c. Releasing Service Fire Alarm Control Unit (RSFACU).
   d. Fire Alarm Control Panel (FACP).
   e. Not Used.
   f. AHU shutdown.
   g. AHU Manometer Test.
   h. Hangar Power Supply test.
   i. Hangar Door Track Heater Test.
   j. Rollup Door Test.
   k. Not Used.

19. Provide names and credentials of manufacturers' representatives who will be conducting the tests IAW the contract.
20. Provide foam tank volume graph indicating volume in gallons corresponding to foam concentrate level in foam tank. This information will be used to calculate concentrate volume required to flow the foam for 15 minutes. The foam tank levels shall be checked by foam manufacturer's representative.

21. Measure foam tank level at the beginning and end of the foam test. This information will be used to calculate concentrate volume required to flow the foam for 15 minutes. The foam tank levels shall be checked by foam manufacturer's representative.

22. Provide a procedure for simulating maximum sprinkler system demand based on supply side calculations. The flow shall be measured by using calibrated equipment such as liquid-filled gages, listed play pipes and Pitot tube. The fire protection specialist shall measure the flow. The foam discharge test is incomplete without this flow. Please note that foam discharge test will be considered invalid without this simulated flow.

23. Provide liquid filled test gages at each foam generator and at the foam system riser. This information is needed to substantiate the hydraulic calculations and to determine actual flow from each generator. It is recommended that sufficient length of hose or tube is provided to take pressure reading at the floor during water only flow. Pressure transducers may be used to take readings.

24. Flow water only thru the generators while also flowing simulated sprinkler flow and observe pressure at each generator and general overall performance of each generator. It is customary and most efficient that hoses or tubing be attached to the gage outlet at the generator and gages themselves be at floor level. Flow rates shall be based on supply side calculations.

25. Mark aircraft outline (silhouette) on the floor with bright red tape and 1 meter cones. This is needed to determine the amount of time required to cover the aircraft silhouette from the activation of manual foam discharge station. Mark the floor with additional colored tape as required to subdivide the aircraft outline into sections to assist in determining the foam coverage percent during the test and review of the video. Ensure that the tape can be readily seen in the video used during the test.

26. The amount of time required to cover 90% of the aircraft silhouette from the activation of manual foam start station shall not exceed 60 seconds. No foam shall fall from the foam generators within the projected aircraft silhouette.

27. Mark the walls or place 1 meter cones or posts at or near the walls, and along and within the aircraft silhouette. Ensure that the 1 meter cones do not interfere with the flow of foam. This is needed to determine the amount of time needed to cover the hangar floor to a depth of 1 meter.

28. Record the amount of time required to cover the entire floor area with foam to a depth of 1 meter which shall not exceed 4 minutes. Once the test director indicates the 1 meter depth has been achieved, depress a "Foam Stop" button on a station remote to the activation station used to initiate the discharge. The foam control valve must close not faster than 5 seconds and not more than 15 seconds.

29. Verification of Hydraulic Calculations: Perform actual flow test of the combined systems while simultaneously flowing water only. Record pressure reading at each foam generator and at base of sprinkler system risers and foam system risers using calibrated liquid filled gages.

30. Verification of Foam Spread Diagram:
   a. Perform actual flow test of the combined system flowing simultaneously (with foam) to verify both one minute criteria and 4 minute criteria.
   b. Develop Foam Spread diagrams if not available from the manufacturer.
31. Provide values of design parameters including:
   a. Design pressure at the base of foam system riser.
   b. Design pressure at hydraulically most remote foam generator.
   c. Value of maximum fire water demand based on supply side calculations.
   d. Value of maximum foam solution flow based on supply side calculations.
   e. Limits of foam solution concentration IAW UL listing of foam and contract requirements.
   f. Design inlet and discharge pressures at the inductor.

32. Provide sufficient quantity of calibrated 3-½" liquid filled pressure gages of proper ranges IAW NFPA 291. List quantity of pressure gages for each range.

33. Flow Test:
   a. Provide the number of playpipes used for each flow test.
   b. Indicate GPM per playpipe.
   c. Indicate pitot pressure for each playpipe.

34. Demonstrate that the foam test header isolation valve is working properly.

35. Test the foam proportioner prior to the full foam test at a flow and for a time recommended by the manufacturer. The intent is to ensure that the foam proportioner is performing as intended prior to the full dump test. This could be a major cost saving to the contractor in case of defective foam proportioner.

36. Actual foam discharge test shall not be conducted with standing water on the hangar floor. Crews and equipment shall be provided to remove standing water. The hangar floor shall not be wet at the start of the test.

37. Provide equipment used for the test such as radios, stop watch, foam fill pump, foam to top the foam tank, lifts, ladders, extension pole, smoke generator, manometer, sufficient cameras and tripods etc.

38. Designate personnel for taking test readings.

39. Test Procedures:
   a. Video-record each test.
   b. Provide adequate number of cameras in the hangar space to facilitate complete coverage without panning across the hangar floor. Ideally stationary overhead cameras are installed with a full view of the aircraft silhouette during the foam test, to use for later determination of the percent aircraft silhouette coverage at 60 seconds and 1-meter depth in 4 minutes. Cameras shall have a full view of the bright red tape on the floor to outline the aircraft silhouette, and additional bright red tape on the floor to subdivide the silhouette into sections. The subdivision will assist in reviewing the video for percent silhouette coverage with foam at 60 seconds.
   c. Sound an air horn or equivalent from the location of the foam start station used to activate the system. This horn shall be sounded when the system is activated. The government shall bear witness that the horn is sounded simultaneously with activation of the foam start station, and shall note and record any time difference in seconds. The horn shall be capable of being heard in the video and by all witnesses throughout the hangar, for time zero determination. This air horn will be used to establish the start time in the video to evaluate the foam coverage of the silhouette in the first minute and the foam depth at four minutes.
d. A second government witness at the foam start station shall radio a government witness in the foam room the exact moment the start station is enabled, so that the government witnesses in the foam room and fire pump room can provide a visible or audible signal for the recording cameras indicating time zero. The government witness in the foam room shall record how many seconds after the test start time before the sprinkler test header valve is fully open.

e. Provide a camera in foam room and pump house to record such things as gage pressures and exact moment foam mixing valve opens at the start of the test and the exact moment the foam outline line valve is closed at the end of the test. For Air Force projects record gauge pressures at the inlet and outlet of the inductor.

f. The video will be very useful in trouble shooting in case of a failed test.

g. The video is an efficient tool for training purposes.

h. Provide (DVD) videos.

i. All cameras shall provide a time stamp on the video.

40. Provide a device lay out plan on 11"x17" sheets for all devices connected to the Releasing Service Fire Alarm Control Unit (RSFACU). Indicate device number.

41. Provide a device lay out plan on 11"x17" sheets for all devices connected to Fire Alarm Mass Notification Control Panel (FMCP). Indicate device number.

42. Provide a riser diagram identifying all tamper switches with device numbers.

43. Demonstrate the functionality of the fire alarm system is in compliance with the FACU and RFSACU functional matrixes.

44. Performance Matrix of Signaling Line Circuit (SLC): Provide a matrix for recording test data for SLC IAW NFPA 72. The fire alarm test will be considered invalid if this test is not done.

45. Performance Matrix of Notification Appliance Circuit (NAC): Provide a matrix for recording test data for NAC IAW NFPA 72. The fire alarm test will be considered invalid if this test is not done.

46. The location of each of the tests (open, ground, short) shall be noted on the matrix and as built drawings.

47. Make sure alarm initiating device address as shown on FACP and RSFACU are a specific location along with device address. Simply stating "Pull Station 2-16" is insufficient. An example of appropriate notation is "Pull Station 2-16, NE Corner Hangar Bay Exit Door".

48. Verify the proper operation of the Low Level Auto Disable Switch in the RSFACU.

49. Test and record sound level of notification appliances IAW NFPA 72 and record the dBA reading for each device near its location on the 11" x 17" device location plan.

50. Test and record MNS system intelligibility and record the CIS reading for each device near its location on the 11" x 17" device location plan. Test the mass notification system in accordance with the requirements of UFC 4-021-01. At a minimum provide sound power levels (Decibel A Weighted Scale (dBA)) and intelligibility scores (CIS) throughout the facility. (Reviewed by the QFPE)

51. Verify and specifically note mounting height of fire alarm devices IAW NFPA 72.

52. Verify and specifically note that the electrical supply for power-operated doors is independent of the building power supply to permit isolation of power to the facility during a fire without interrupting power to door motors.

53. Verify and specifically note that a key-operated or other access-controlled switch on the exterior of the facility for operation of power operated doors is provided.
54. Verify and specifically note whether the foam start and stop stations, associated conduit and back boxes, meet watertight and NEMA 4 requirements to prevent moisture entry.

55. Verify and specifically note that power supplies to RSFACU, FACP and MNS panels are provided and identified IAW NFPA 72. Check to verify and specifically note that wire-nuts are not used. Perform random checks by opening junction boxes to verify that screw type terminal blocks have been used throughout. Report findings.

56. Verify and specifically note that surge arrestor pre-charge pressure is indicated on surge arrestors.

57. Verify and specifically note that a pressure gage with isolation valve is provided at surge arrestors to monitor pressure. Record pressure.

58. Verify that meger tests and loop resistance tests have been completed and test reports provided.

59. Verify that a tamper switch is provided for foam concentrate shutoff valve. Presence of TS should be noted on Tamper Switch matrix.

60. Demonstrate the performance criteria for opening and closing the flow control valve is met upon actuation of the manual foam stop stations. A water only test is acceptable. (Witnessed by the government fire protection engineers)

61. Verify that any and all valves in the system that when closed will disrupt or stop the flow of foam solution, foam concentrate, water, or that will disrupt or prevent an alarm signal or disrupt or prevent the opening of the deluge valves are electronically supervised. Presence of TS should be noted on Tamper Switch matrix.

62. Verify that if a valve is installed in the connection between an alarm initiating device intended to signal activation of a fire suppression system, the valve is supervised IAW NFPA 72. Presence of TS should be noted on Tamper Switch matrix.

63. Verify and specifically note that conduit routing for alarm systems are IAW NFPA 72 for conduit separation distances for horizontal and vertical runs.

64. Verify and specifically note that all pipe and conduit penetrations are sealed with listed fireproofing material. Provide catalog cut of fireproofing material.

65. Verify and specifically note that all fire protection pipes, valves, test headers, FDC are labeled and that labels have been adapted to properly indicate flow direction.

66. Provide system restoration and flushing procedure after the completion of acceptance test.

67. Ensure sufficient quantity of foam is available to top the foam tank at the end of the tests.

68. Provide a pump for filling the foam tank from the foam drums.

69. Preliminary Test Report:

   a. Provide preliminary test report for all fire protection related specification sections with table of contents in a binder for approval prior to scheduling final acceptance test.

   b. Include copies of all test reports required by the specifications and NFPA codes such as NFPA 11, NFPA 13, NFPA 20, NFPA 24, NFPA 72 etc.

   c. Include copies of meger test and loop resistance test data. Please note that FACP, RSFACU and MNS tests will be incomplete without loop resistance and meggar test data.

   d. Include copies of test procedures for each fire protection related specification section.

   e. Include copies of forms to record test readings.

   f. Include copies of credentials of manufacturer's representatives who will actually be present at the site.
70. Final Acceptance Test Plan:
   a. Include table of contents.
   b. Submit hard copy of Final Acceptance Testing Plan and Procedures, and forms for recording test data in a three ring binder with tabs.
   d. Note that the Final Acceptance Test is a repeat of the Preliminary Acceptance Test, with the exception of hydrostatic tests of aboveground and underground pipe, underground pipe flush, and megger and loop resistance tests.

71. Training Lessons Plan: Provide training lesson-plan for systems for each specification section.

72. General:
   a. Determine the status of each item prior to commencing final acceptance test.
   b. Take appropriate action to make this a successful test.
   c. Determine the status of each item after the completion of final acceptance test.

73. Any and all tests which are left as incomplete after the FAT must be corrected then successfully retested in the presence of the AHJ, QFPE, and fire protection designer of record.

74. It is critical that the electrical disciplines (alarm and MNS) and mechanical disciplines (sprinkler and HEF) both have a responsible QC person involved in the project. It is equally essential that these two individuals coordinate their efforts, or actually be the same person.

75. The purpose of the PAT is to ensure that the FAT is conducted flawlessly. It is the contractor’s responsibility to perform tests and make repairs to the system until they can conduct a "perfect" PAT completely and without incident or failure. If a failure is noted during any portion of what the contractor calls the PAT, the item shall be corrected and then the entire testing process shall be repeated until it is completed flawlessly from start to finish. Then, and only then, can it be claimed that a successful PAT has been completed. Only after a successful PAT is completed and the report reviewed and accepted by government can a FAT be scheduled.

76. Provide equipment used for the test such as radios, stop watch, foam fill pump, foam to top the foam tank, lifts, ladders, extension pole, smoke generator, manometer, sufficient cameras and tripods etc.

77. Provide sufficient quantity of calibrated 3-½" liquid filled pressure gages of proper ranges IAW NFPA 291. List quantity of pressure gages for each range.

3.22 PRELIMINARY AND FINAL FOAM TEST

A. Requirements: The Final Acceptance Test (FAT) shall be a repeat of Preliminary Acceptance Tests (FAT), except that flushing and hydrostatic tests shall not be repeated. In addition, the system shall be automatically actuated and allowed to discharge for a period long enough to verify compliance with design requirements prior to shutting the system off. The Contractor shall correct system failures and other deficiencies identified during testing and shall retest portions of the system affected by the required corrections.
1. Pretest Requirements for Final Acceptance Testing: The system will be considered ready for Final Acceptance Testing (FAT) only after the following have been accomplished.
   
   a. The required test plan has been submitted and approved by the Contractor Officer.
   b. Preliminary Acceptance Tests have been completed, including Preliminary Acceptance Testing of the Optical Flame Detection System, Fire Alarm/MNS and Releasing System, and deficiencies determined to have been corrected to the satisfaction of the equipment manufacturer's technical representatives and the Contracting Officer.
   c. Preliminary Acceptance Test reports, including the required video of the Preliminary Acceptance Tests, have been submitted and approved by the Contracting Officer, AHJ, QFPE, and fire protection designer of record.
   d. The control panels shall have been in service for a break-in period of at least 14 consecutive days prior to the final test.
   e. The Contractor has provided written notification to the Contracting Officer, at least 21 days prior to date of Final Test, that preliminary tests have been successfully completed. Contracting Officer shall notify immediately the AHJ and fire protection designer of record.

2. Video: Contractor shall video the tests in disc (or digital) format and shall record the date and time-lapse, in seconds, from start to finish of each portion of the test as directed by the Contracting Officer. The high expansion foam (HEF) discharge test will most likely require multiple cameras for complete documentation. The cameras filming the high expansion foam discharge on the hangar floor cannot pan. Four copies of the disc (or digital) shall be submitted before the system will be considered accepted.

3. Manufacturer's Services: Provide the services of representatives or technicians from the manufacturers of the low-level high expansion foam generators system, foam system control panel, and optical flame detectors experienced in the installation and operation of the type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of the system and to provide instruction to Government personnel. The foam system control panel manufacturer shall provide a minimum of 4-days startup assistance.

4. Materials and Equipment: Contractor shall provide concentrate, gauges, sample collection apparatus, instruments, hose, personnel, elevating platforms, scaffolding, ladders, appliances and any other equipment necessary to fulfill testing requirements specified.

5. Facility and Environmental Protection:
   
   a. Provide temporary measures to prevent high expansion foam solution or high expansion foam concentrate from entering storm drains, sanitary sewers, drainage ditches, streams and water courses. Do not allow high expansion foam concentrate or solution to come in contact with earth. Contain all discharged HIGH EXPANSION FOAM on paved surfaces. Collect all discharged high expansion foam solution; all rinse and flushing water and dispose of it in a State/EPA - approved sanitary waste-water, State/EPA - approved industrial waste-water, treatment facility which provides secondary (biological) treatment. Prior
to the start of construction, submit written plan for high expansion foam containment and disposal methods(s) to the Contracting Officer for approval.

b. Provide protection for the facility, including electrical and mechanical equipment exposed to possible damage during discharge tests. This shall include provision of sandbags or similar means for preventing migration of foam solution into adjacent areas. Temporary measures shall be provided to prevent foam solution from entering storm drains, sanitary sewers, drainage ditches, streams and other water sources. Discharged foam shall be contained on paved surfaces and shall not be allowed to come in contact with the earth.

B. Post-Discharge Test Requirements: Following the successful completion of the tests, the contractor shall completely drain any water or foam water solution between foam system control valves and foam generators. Thus all piping between the foam control deluge valves and foam generators is dry. Contractor shall remove the foam solution from the site as indicated on the approved foam waste containment and disposal plan. Contractor shall replenish foam concentrate consumed during the tests. The entire fire protection system shall be returned to automatic operation and the facility restored to operational capability. Discharged solution shall be contained and disposed of in a manner acceptable to local authorities and as identified on the approved test plan. Once tests are completed, systems shall be returned to fully operational status, including filling of High Expansion Foam concentrate tanks with concentrate and filling of solution piping with premix as required.

3.23 PRELIMINARY AND FINAL HIGH EXPANSION FOAM TESTS

A. The High Expansion Foam hangar fire suppression system flow tests shall include the following:

1. Simultaneous flow of simulated overhead sprinkler system maximum demand and foam generators flowing water only. Take pressure readings at each foam generator and risers with calibrated liquid filled gages.

2. Simultaneous flow of simulated overhead sprinkler system maximum demand and foam generators flowing foam for one minute. Simulated overhead sprinkler system flow is to be based on supply side calculations. All water flow testing shall be done in accordance with NFPA 291. Verify that 90% of the aircraft silhouette is covered in one minute (no depth is specified), and that the entire hangar floor is covered to a depth of one meter in 4 minutes. Foam discharge will continue until these criteria are deemed to be satisfied. Take foam tank level readings at beginning and at end. Overhead sprinkler system maximum demand shall be simulated by using a simulation test header, listed play pipes and liquid filled pressure gages.

3. Foam tank level readings shall be recorded at the beginning and at the end.

4. The high expansion foam system discharge test is to begin with the fire pump not running.

3.24 SAFETY PLAN
A. Provide a safety plan for conducting the test of the High Expansion Foam system. Provide a sketch of safe egress path for persons conducting and witnessing the test to exit the building without entering the foam blanket. Obtain approval from the installation Safety Manager.

3.25 DISPOSAL PLAN AND PROTECTION

A. Provide Foam Containment Plan and Procedures.

B. Provide Foam Disposal Plan and Procedures.

C. Protective Measures: Provide procedures for taking protective measures to avoid damage to property during and after the test protection of property during the Final Acceptance Test.

3.26 PRELIMINARY ACCEPTANCE TEST REPORT

A. Submit the Preliminary Acceptance Test report, and video recording of the event, to the Contracting Officer Representative, before requesting a Final Acceptance Test. Provide the “Punch List” (list of deficiencies prepared at the completion of preliminary test), and a Final Acceptance Test plan 15 days prior to final acceptance test.

3.27 FINAL ACCEPTANCE TEST

A. The Final Acceptance Test shall begin only after approval of the Preliminary Acceptance Test report. The Final Acceptance Test will be a repeat of all Preliminary Acceptance Test requirements except do not repeat flushing and hydrostatic tests. The PAT and FAT shall be witnessed by the Contracting Officer's Representative, the fire department, AHJ, and the fire protection specialist. Additionally, after successful PAT, the AHJ, QFPE, and fire protection designer of record, shall witness and approve the FAT. The Final Acceptance Test and shall provide a complete demonstration of the operation of the system.

B. Video tape of preliminary and final Hi-Ex foam discharge test. A professional videographer will record or video the Final Acceptance Test. A failed FAT will be treated as a PAT. Correct and retest all system failures or other deficiencies identified during the testing in the presence of the Contracting Officer's Representative, the fire department, the fire protection specialist, AHJ, QFPE, and fire protection designer of record.

3.28 FINAL ACCEPTANCE TEST REPORT AND AS-BUILT DRAWINGS

A. Provide the Final Acceptance Test Report within 15 days after the completion of the Final Acceptance Test. Provide the final acceptance test report in booklet form showing field tests performed with the digital or videotape of the final test to document compliance with the specified performance criteria. Provide documentation of readings, test results, and indicate the final position of control valves. Include all required Final Acceptance Test NFPA forms. The Final Acceptance Test report shall include the resolution of punch list items developed during preliminary acceptance testing. Submit As-built Drawings.
3.29 FLUSHING AND RINSING

A. After completion of tests flush all piping carrying HIGH EXPANSION FOAM solution with fresh water. Rinse with fresh water all equipment and building surfaces exposed to HIGH EXPANSION FOAM discharge.

3.30 POSTED INSTRUCTIONS

A. Framed description of system operation, instructions and schematic diagrams of the overall foam system and each subsystem, shall be posted where directed. Condensed operating instructions explaining the system for normal operation, refilling the foam storage tank, and routine testing shall be included.

B. Provide instructions for operating the fire extinguishing system at control equipment and at each remote control station. Instructions shall clearly indicate all necessary steps for the operation of the system. Submit the proposed legend for operating instructions for approval prior to installation. Instructions shall be in engraved white letters on red rigid plastic or red enameled steel backgrounds and shall be of adequate size to permit them to be easily read.

3.31 TRAINING

A. Prior to final acceptance, the Contractor shall provide two sessions of 4 hours each of operation and maintenance training to the installation personnel on two different days to accommodate both shifts of the Installation Fire Emergency Services. Each training session shall include emergency procedures, and unique maintenance and safety requirements. Training areas will be provided by the Government in the same building as the protected areas. The training conducted shall use operation and maintenance manuals specified in paragraph entitled "Operations and Maintenance Manuals". Dates and times of the training period shall be coordinated through the Contracting Officer not less than two weeks prior to the sessions.

B. Lesson plans, operating instructions, maintenance procedures, and training data shall be furnished in manual format for the training courses. The operations training course shall familiarize designated government personnel with proper operation of the fire protection systems. The maintenance training course shall provide designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system. The training sessions shall be given for two different work shifts. The schedule of training shall be approved by the Contracting Officer. Training sessions shall start after successful completion of the Final Acceptance Test. The field instruction shall cover all of the items contained in the approved O&M manual. Film or tape all training sessions and provide to the Government.

END OF SECTION 21 13 25
SECTION 21 31 13 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

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. Horizontally mounted, single-stage, split-case fire pumps.
   2. Fire-pump accessories and specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fire pumps, 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.

B. Product Certificates: For each type of fire pump, from manufacturer.

C. Source quality-control reports.
D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS


B. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Component Importance Factor: 1.5.

C. Pump Equipment, Accessory, and Specialty Pressure Rating: 250 psig minimum unless higher pressure rating is indicated.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

A. Description: Factory-assembled and -tested fire-pump and driver unit.

B. Base: Fabricated and attached to fire-pump and driver unit, with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.3 HORIZONTALLY MOUNTED, SINGLE-STAGE, SPLIT-CASE FIRE PUMPS

A. Pump:

1. Standard: UL 448, for split-case pumps for fire service.
3. Impeller: Double suction, cast bronze, statically and dynamically balanced, and keyed to shaft.
5. Shaft and Sleeve: Alloy steel shaft with bronze sleeve.
   a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
   b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

6. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.

B. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.

C. Driver:
   1. Standard: UL 1004A.
   2. Type: Electric motor; NEMA MG 1, polyphase Design B.

D. Capacities and Characteristics:
   1. Rated Capacity: 2,500 gpm.
   2. Total Rated Head: 200 psig.
   3. Inlet Flange: Class 250.
   4. Outlet Flange: Class 250.
   5. Suction Head Available at Pump: 2 feet.
   7. Motor Speed: 1,785 rpm.
   8. Electrical Characteristics:
      a. Volts: 460 V.
      b. Phase: Three.
      c. Hertz: 60.
      d. Full-Load Amperes: 515 A.


2.4 FIRE-PUMP ACCESSORIES AND SPECIALTIES
A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.

C. Relief Valves:
   1. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.

F. Discharge Cone: Closed or open type.

G. Hose Valve Manifold Assembly:
   5. Manifold:
      a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
      b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
      c. Escutcheon Plate: Brass or bronze; round.
      d. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
      e. Exposed Parts Finish: Rough brass.
      f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

2.5 FLOWMETER SYSTEMS
   A. Description: UL-listed or FM-Approved, fire-pump flowmeter system able to indicate flow to not less than 175 percent of fire-pump rated capacity.

   B. Pressure Rating: 250 psig.

   C. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.

   D. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches in diameter. Include bracket or device for wall mounting.
      1. Tubing Package: NPS 1/8 or NPS 1/4 soft copper tubing with copper or brass fittings and valves.

2.6 GROUT

   B. Characteristics: Nonshrink and recommended for interior and exterior applications.

   C. Design Mix: 5000-psi, 28-day compressive strength.

   D. Packaging: Premixed and factory packaged.
2.7 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."

1. Verification of Performance: Rate fire pumps according to UL 448.

B. Fire pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of fire pumps.

B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.

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

3.2 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.

B. Equipment Mounting:

1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete." Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

D. Support piping and pumps separately, so weight of piping does not rest on pumps.
E. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Section 211313 "Wet-Pipe Sprinkler Systems."

F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Section 211313 "Wet-Pipe Sprinkler Systems."

G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.

H. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.

I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

J. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

A. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

C. Align piping connections.

D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Section 211313 "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge to drainage piping or point of discharge.

D. Connect flowmeter-system meters, sensors, and valves to tubing.

E. Connect fire pumps to their controllers.
3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Section 262933 "Controllers for Fire-Pump Drivers."

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

   1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
   2. Test according to NFPA 20 for acceptance and performance testing.
   3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

F. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

   1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 21 31 13
SECTION 21 34 00 - PRESSURE-MAINTENANCE PUMPS

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. Vertical, multistage, pressure-maintenance pumps.
   B. Related Requirements:
      1. Section 26 29 33 "Controllers for Fire-Pump Drivers" for pressure-maintenance-pump controllers.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
   B. Shop Drawings: For pumps, accessories, and specialties.
      1. Include plans, elevations, sections, and attachment details.
      2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
      3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS
   A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For pumps to include in operation and maintenance manuals.
PART 2 - PRODUCTS

2.1 VERTICAL, MULTISTAGE, PRESSURE-MAINTENANCE PUMPS

A. Description: Factory-assembled and -tested, multistage, barrel-type vertical pump as defined in HI 2.1-2.2 and HI 2.3; designed for surface installation with pump and motor direct coupled and mounted vertically.

B. Pump Construction:

2. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
3. Pump Head/Motor Mount: Cast iron.
4. Impellers: Stainless steel, balanced, and keyed to shaft.
6. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
7. Wear Rings: Teflon.
8. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
10. O-Rings: EPDM.

C. 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.

D. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head. Comply with requirements in Section 21 05 13 "Common Motor Requirements for Fire Suppression Equipment."

E. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feetlong.

F. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

G. Capacities and Characteristics:

1. Rated Capacity: 10 gpm.
2. Total Dynamic Head: 210 psi.
5. Discharge and Suction Flanges: Class 250.
6. Suction Head Available at Pump: 2 psi.
9. Electrical Characteristics:
   a. Volts: 480.
   b. Phases: Three.
   c. Hertz: 60.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 210513 "Common Motor Requirements for Fire Suppression Equipment."

   1. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. NFPA Standard: Comply with NFPA 20 for installation of pressure-maintenance pumps.

B. Equipment Mounting:

   1. Install multistage, pressure-maintenance pumps according to HI 1.4.
   2. Install base-mounted pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

   a. Comply with requirements for vibration isolation and seismic control devices specified in Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
   b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   d. Install anchor bolts to elevations required for proper attachment to supported equipment.
   e. Attach pumps to equipment base using anchor bolts.
   f. Shim pumps as needed to make them level.

   3. Install isolation valves in both inlet and outlet pipes near the pump. Comply with requirements for valves specified in Section 211313 "Wet-Pipe Sprinkler Systems."

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Pressure-maintenance pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Lubricate pumps as recommended by manufacturer.

B. Set field-adjustable pressure-switch ranges as indicated.

END OF SECTION 21 34 00